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ABSTRACT

This report describes a study to verify the impact on vocational training policies of research and development work carried out in the field of anticipation of educational and training needs, labor market forecasts, and skills analysis. Section I provides background. Section II presents the framework of the study. Section III includes the full case studies. They follow a common structure: preface, description of study, and analysis of impact. The six case studies are as follows: "Market Scanner for the Installation Sector"; "'Occupational Analysis' in the Field of Inland Navigation"; "'Qualification Analysis' for Revision of Initial Training for Motor-Vehicle Mechanics"; "Action Research for Job Improvement in the Plastics Industry"; "'Technological Development and Changing Demands on Qualification in the Construction Sector' and Its Impact on the Revision of the Ordinance for 17 Construction Occupations"; and "'Foundations and Suggestions for a New Training Ordinance: Data Processing Clerk' and Its Impact on Four New Ordinances in the Information Technology Sector." Section IV includes these conclusions: specific research results are often an important but not the sole information source for curriculum development; the researcher should perhaps be more concerned with the stimulation of curriculum development; and research aimed at revision of existing forms of education may differ from that aimed at development of new forms of educational practices. (42 references) (YLB)

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CEDEFOP Document

The impact on vocational training of studies Analysing and forecasting trends in occupations

Case studies in Germany, the Netherlands and Denmark

European Centre for the Development of Vocational Training

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The impact on vocational training of studies
Analysing and forecasting trends in occupations

Case studies in Germany, the Netherlands and Denmark

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I. Preface

Vocational education and training research - and specifically forecasting trends in occupations - is carried out with the objective of providing information on the interactions between VET and other socio-economic areas which should then contribute to the decision making processes of the various actors involved.

This study, which was conducted in three countries - Germany, The Netherlands and Denmark - aimed to verify the impact, on vocational training policies, of research and development work carried out in the field of anticipation of educational and training needs, manpower forecasts and skills analysis. The study envisaged the identification of factors which positively and/or negatively influence the impact of research on training and skill needs, i.e. new occupational profiles, curricula development, teaching methods, training regulations. A better understanding of these factors could contribute to improving the collaboration between research and policy and therefore bringing vocational education and training closer to the labour market.

The study was launched during the plenary meeting of the Network on Trends in Occupations and Qualifications (Ciretoq) of 11 and 12 June 1996. Due to its socio-economic nature and its specific accent on qualitative aspects, it was decided to develop this study in the framework of the activities of Group B, "Socio-economic comparative analysis and prospects". The final results of the study were presented during the Ciretoq plenary meeting of June 1997.

The study was conducted on behalf of Cedefop and in collaboration with DTI (Danish Technological Institute), CINOP (Centre for the Innovation of Education and Training) and the Technical University of Berlin by the following working group:

- Kaj Olesen (DTI), external co-ordination of the project
- Claus Agø Hansen (DTI), Danish case study and editing of the synthesis report
- Ties Pauwels, (CINOP), Dutch case studies
- Günter Heitman (TU Berlin), German case studies. Georg Hanf (BIBB) collaborated in the research.

Mara Brugia and Burkart Sellin
Project Co-ordinators

II. INTRODUCTION: The framework of the study

1. Background

The idea for this project originated in the Ciretoq network, which was set up by CEDEFOP in May 1995 as part of the Centre's Work Programme. The Ciretoq network consists of some 20 research institutions from the Member States, which regularly undertake studies on trends in occupations and qualifications on behalf of ministries or EU institutions.

This project was proposed to the participants in the group on qualitative studies by the Danish Technological Institute (DTI Human Resources Development). In addition to DTI Human Resources Development, which has been the main contractor and project co-ordinator, two institutions participated in the study:

- The Technical University of Berlin (TU Berlin), Institut für berufliche Bildung, Hochschulbildung und Weiterbildungsforschung (IBHW)

- The Centrum Innovatie Beroepsonderwijs Bedrijfsleven (CIBB, now part of CINOP)

Each of the three institutions contributed two case studies, so that the report contains six.

2. Objectives

Most research - analyses and forecasting trends in occupations - is carried out with the idea of changing, or at least having an impact on, vocational training, e.g. on curriculum development, teaching methods, training tools or assessment procedures. But do they have this impact?

The main objective of this study was to examine which factors facilitate and which hamper the impact of specific qualification research findings on training and education in order to promote a better understanding, enabling us to improve the collaboration between research and training, thereby bringing VET (Vocational Education and Training) closer to the labour market.

The findings from the case studies are explorative. The studies are neither representative, nor do they give a full picture of possible methodological approaches to occupational analysis. They are mainly a sample of well-documented experiences which should serve as inspiration for future research. Suggestions for future research are made in section 1.6.

A useful frame of reference for the findings of these case studies is the national reports from

- *the CEDEFOP study on 'Systems and Procedures of Certification of Qualifications'*[1]

- *the DG V study on 'Instruments, Tools and Policies to Anticipate the Effects of Industrial Change on Employment and Vocational Qualifications'.*

The case studies include only very brief introductions to the political and organisational environment of the studies. However, the national reports contain detailed descriptions of systems, procedures, tools etc., and the reader should therefore make reference to these.

3. Methodology

Originally, the criteria for the selection of case studies were that each member should identify one successful and one less successful example. We should then search for explanations for the differences in impact between these.

We first discussed what might be meant by a 'successful' example and agreed to focus both on impact regarding training regulations and impact regarding educational practices, the perception of actors etc. On this basis we looked for adequate case studies.

The choice of case studies was restricted by the demand for only well-documented cases. Due to the restricted scope of this study, we also had to choose cases of which we already had some knowledge. There was neither time nor financial resources to search for and investigate research results of which we had no prior knowledge.

We had to recognise that at this first stage we did not really know the full impact of the cases we intended to describe. Our knowledge of the impact was therefore to be a result of our study rather than a criterion for case-study selection.

We therefore decided to select six cases using the following criteria: studies which contained different methodological approaches and objectives (1), to see whether interesting lessons could be learned on the 'effectiveness' of different methodological approaches with regard to impact. In addition to investigating both examples of quantitative and qualitative studies, we chose cases where the researcher had various roles (2), to see whether this might affect the impact. Finally, (3) the case studies should partly focus on the revision of existing curricula and partly on examples with significant emphasis on future demands resulting in the establishment of curricula for new occupations, for new training or work organisation approaches or for more flexible and 'on-line' patterns to update vocational education and meet new needs.

The chosen cases cover quite a broad range of different objectives. Some cases focus on the modernisation of existing vocational education, while others aim to construct new occupational profiles or to show the potential for the development of work organisations at enterprise level.

The case data were collected through interviews with key players in the projects and by studying documentation. Each case was then prepared in draft form and discussed among the project team at general meetings.

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1 See references at the end of the report.

Attention was given to the following topics:

- Field of the survey and its purpose
- Background to the study
- Methodology of the study
- Actors and social processes
- Project organisation and study period (length)
- Impact of study

An overview of how the case studies compare with each other with regard to goals, focus, type of analysis, sample, methodology and time span can be seen in Diagram A (p. 11).

4. Introduction to the Case Studies

The full case studies are included in the second part of this report. They follow a common structure with a preface (1), description of study (2) and analysis of impact (3). A brief introduction to the case studies follows below.

Summary of Case Study 1: 'Market Scanner' for the Installation Sector (NL)

Intechnium is the national body for vocational education in the installation sector. The goal of the project Market Scanner was to develop - in co-operation with staff members of Intechnium - a research method with which Intechnium can identify each year the developments and innovations implemented in the sector. Based on this information, Intechnium can develop an action plan for the dissemination of skills and knowledge by means of seminars, courses, articles in professional journals or adjustment of the qualification structure for initial vocational education (i.e. occupational profiles). The project for developing and implementing a market scanner lasted two years. During the two years, an expert network was set up for the four subsectors of the installation sector, a standardised questionnaire was developed, research was carried out in each subsector, reports containing the results were written, statistical programmes were developed, including software for time series, and finally a manual was written in which every step of the process is described in detail. The impact of the project is twofold:

1. It led to new courses, adjustments in subjects in education, articles in professional journals, exhibitions etc. After each item of research, Intechnium writes a plan for implementing the results of the research in further action; how this is done is described in detail in the handbook on the procedure for the market scanner.

2. The project also led to the realisation that the research method can be improved: modifications are necessary (and will be implemented in 1997) in the research method with regard to the sample-taking at an individual level (a) and the information which is collected (b).

a. Major advantages of the new procedure for taking samples are:

- The enterprises in the panel will not have to complete a huge questionnaire every time, as some questions only need to be asked once

- It is much easier to observe changes within the enterprises
- For the smaller subsectors in particular: enterprises are not asked to participate in the research every two or three years, and the risk of enterprises becoming weary and consequently refusing to participate is diminished
- The enterprises know much better what is expected of them.

b. In the original framework of the market scanner, only data on the enterprise level were collected. This is now regarded as a major shortcoming of the project by the policy-makers at Intechnium. They increasingly want information on an individual level such as:

- What are the strategies adopted by the employers to find new personnel if the enterprise grows: will they hire apprentices or are they more interested in trained professionals?
- With regard to a particular development: why does one profile obtain new tasks and why are there no changes for another profile?
- Why is enterprise x very innovative and enterprise y not?
- More information with regard to the development of individual professional careers of professionals within companies.

This means that the research questions have changed, and therefore that the questionnaires have to be changed. Priorities have to be established in the developments which are selected for the research. Some developments will be examined only at a very superficial level, merely to discover whether the introduction of the developments shows any stagnation (questions such as: is this development applied in your enterprise, since when, how often?). Other developments will be examined in depth: what are the bottlenecks in working with the innovation, what has improved as a result of the innovation and what has deteriorated, what is the need for knowledge and skills as a result of the introduction etc.

This information is needed to optimise Intechnium's policy in the field of occupational profiles and curricula, courses and all other activities which Intechnium performs in order to be an innovative national body for secondary education. These new procedures will be implemented in 1997.

Summary of Case Study 2: 'Occupational Analysis' of Inland Navigation (NL)

The goal of the study was to analyse the occupational structure in inland navigation. A method for occupational analysis called the Mantel project was used, with which the actual activities of workers in certain occupation can be described and measured. The result is not a description of a single occupation, but an overview of the content of many occupations (occupational profiles) within a job family, in this case inland navigation. The method yields detailed information on the occupational structure within a certain field and on the contents of each occupation within this structure. The results of the research can be translated into curricula for the benefit of vocational education. The results provide a rather static picture of the occupational structure. The national body for inland navigation had plans to carry out an additional study on future developments, but no such research has as yet been initiated.

A critical point in the research procedure is the final establishment of the profiles. In the Vocational Education Act, it is laid down that the CET (a committee of employers, employees and vocational schools) is responsible for the approval of profiles. The risk is that political issues, such as pay, play an important role in the decision-making process. In the case of inland navigation, politics did indeed play an important role. This is the reason why the final outcomes of the research (five occupational profiles: sailor, able sailor, navigating officer, captain and ship's master/entrepreneur) were altered by the CET. In the new qualification structure, only four profiles exist: sailor, boatswain, navigating officer/ship's master and captain. The boatswain is a function which was not analysed in the research. This profile did not appear in the research findings either because boatswains do not work on inland-navigation ships, but in harbours.

The national body needed new occupational profiles because the curricula for initial vocational education were outdated. However, the findings from the research are not copied for the sake of curriculum development, partly because a curriculum is something other than a profile, and the activities and clusters belonging to a profile need to be re-arranged to develop a coherent and logical curriculum.

Another reason, however, for all the changes is the legal obligation that employers as well as employees are members of the CET, which is responsible for the profiles and the curriculum.

The newly developed curricula correspond to daily practice in inland navigation. The old curriculum for the sailor in particular was far too theoretical. The research - as a final conclusion - was helpful to the development of curricula, but not decisive.

Summary of Case Study 3: 'Qualification Analysis' for Revision of Initial Training for Motor-Vehicle Mechanics (DK)

This case study describes the use of qualification analysis as a tool for the renewal of initial vocational education. Qualification needs and demand analysis are applied at sector level (the motor-vehicle repair industry) and targeted at a specific occupation (motor-vehicle mechanics). The objective is to renew the existing vocational motor-vehicle mechanic education at national level.

The methodology is qualitative, aimed at giving a broad but not representative picture of present and future trends in the enterprises. This is done by analysing present qualification gaps and future developments regarding tasks and qualifications. The primary source of information is personal interviews, supplemented by observations of work organisation and physical arrangement of the workplace.

The research findings include descriptions of present and future tasks to be performed in motor-vehicle repair jobs and the qualifications needed to perform these tasks. The qualifications are described in categories known and used by the joint committees in Denmark. This facilitates curriculum development.

The impact of the study is modernisation of the existing motor-vehicle mechanic education and an information campaign among enterprises and technical schools on the new educational structure and content. The study shows that the selection and use of categories can facilitate the impact of research results. If the analyst uses 'language' familiar to vocational educationalists, this may improve the transfer of results. The study also shows, however, that curriculum development is a process involving bargaining of interests, and that research results are not directly 'transferred' into the curriculum.

Summary of Case Study 4: Action Research for Job Improvement in the Plastics Industry (DK)

This case has two main points of focus. Firstly, it shows how qualification analysis is used as a tool for developing CVT courses for semi-skilled operators in the plastics industry. Secondly, it shows how the developed CVT courses can be used to change work organisation at enterprise level in an action research project, thus increasing job improvement and functional flexibility.

Qualification needs and demand analysis are applied at sector level in the plastics industry. The objective is to forecast how jobs will develop and how CVT courses can support this by developing the appropriate qualifications.

The methodology is qualitative, aiming to provide a picture of present trends in technologically sophisticated enterprises. This spearhead approach is chosen on the assumption that this is the way in which the plastics industry will develop as a whole in the future.

The primary source of information is observation of work functions, from which the consultants deduce or translate descriptions of qualification needs. Secondary information is gathered from personal interviews with workers and management representatives. The analysis results are descriptions of work functions and qualifications and illustrations of the room for manoeuvre in work organisations. Qualifications are described using a modified form of the SOFI-Göttingen categories (Mickler et. al. 1977) which are known and used by the joint committees in Denmark, but which have not found direct use in vocational education.

The impact is the development of CVT courses aiming to produce the qualifications described. These courses are used in an action research project to demonstrate how CVT courses and qualification development can promote new forms of work organisation which are both flexible and job-enriching.

The project shows how great learning potential can be realised in production units by introducing CVT courses and developing work organisation. It also shows, however, that many barriers and considerable resistance are to be overcome at both individual and organisational levels.

Summary of Case Study 5: 'Technological Developments and Qualification Demands in the Construction Sector' and its Impact on the Revision of the Construction Vocations Ordinance (D)

This case study focuses on a report on changing qualification needs and demands in the building and construction trade, commissioned by the Federal Institute of Vocational Education (BIBB) in 1993, conducted by social scientists and vocational educationalists from the Hochschule Bremen in collaboration with groups from Hamburg, Dortmund and Jena. The study was based on expert interviews. To cover most kinds of work functions and vocational activities in the construction sector, 15 main occupational fields were defined and four different types of enterprises were identified. A total of 58 enterprises in different regions of Germany were included in the sample and 114 interviews were conducted.

Results of the study were comprehensive lists of work assignments and activities in each field, indications about clusters of activities, changing and future needs and qualification deficits of the current workforce and the respective occupations. The results of the study are used within the process of redesigning the vocational training regulations and the corresponding vocational school curricula in 17 different occupations in the construction sector. These different occupations have so far been regulated by an ordinance dating back to 1974, which consists of a common basic year and increasing specialisation in the second and third years of the vocational education and training.

The impact on the revision process of the existing construction occupations to date has been found in the preliminary documents and the draft of the new ordinance: based on the results of the study, a comprehensive list of 876 activities in 15 different occupational fields in the construction sector was developed representing all current and expected needs and demands in this sector which must be catered for. Regarding the drafts for the future ordinance, the positive impact of the study can be observed particularly in the massive increase in transfer knowledge and skills and key qualification mainly with respect to changes in the first common year of vocational education. Additional effects of the study are to be expected or have been observed in the field of teaching and learning media and methods, in the area of vocational guidance and information regarding these vocations and in vocational teachers' training.

Summary of Case Study 6: 'Foundations and Suggestions for a New Ordinance: Data-Processing Clerk' and its Impact on Four New Ordinances in the Information Technology Sector (D)

From 1992 to 1994, the Federal Institute for Vocational Training (BIBB) carried out a study to find the basis for a new (revised) training ordinance for the 'Datenverarbeitungs-kaufmann/-kauffrau' (Data-Processing Clerk, DPC) and to make suggestions for a new occupational profile. A series of case studies was carried out involving nine typical enterprises covering the main employment areas of DPCs. The study aimed to revise an existing profile, and its methodological approach served this purpose quite well. An important impact was the discussion and breaking down the limitations of the existing profile.

The results of the study did not lead to *one* new training ordinance, but because of two new objectives set by the government and the social partners, different parts of it were used as essential elements for *four* completely new IT traineeship profiles including a cluster of key qualifications defined by the study. Most of the findings were converted into the new skeleton training plans.

As regards the methodology, the restructuring of the wider occupational area, of which existing profiles only form part, requires a permanent observatory and a representative survey on that area before case studies with selected companies are carried out. As regards the 'processing' of research results, a rather high impact of trend studies on VET is in principle guaranteed in Germany because of the high degree of structural and personal continuity in the whole process from the commissioning of a study to the training plan.

III. CASE STUDIES

Diagram A: Schematic Outline of the Characteristics of the Case Studies

		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
		NL Market Scanner	NL Inland Navigation	DK Motor-vehicle mechanic	DK Job Improvement in Plastics Industry	D Occupatio-nal Profiles in the Construc-tion Sector	D Training Regulations for Data-Processing Clerks
Goal	Revise existing curriculum/profiles	x		x		x	x
	Develop new curriculum/profiles		x		x		
	Job development				x		
	Other						
Focus	Occupations			x		x	x
	Job profiles	x	x	x	x	x	x
	Qualifications			x	x		x
	Activities/tasks		x	x	x	x	x
	Work functions/clusterof activities	x			x	x	
	Work organisation				x		
	Learning strategies/practices				x		
	Recruitment				x		
Commiss-ioned by		National body	National body	Social partners (trade committee)	Social partners	Board of BIBB	Board of BIBB
Type of analysis	Needs analysis		x	x		x	x
	Future needs/developments	x		x	x	x	x
	Action research				x		
Method	Quantitative	x	x				
	Qualitative:			x	x	x	x
	- Open questions			x	x	x	x
	- Standardised					x	x
	- Observations			(x)	x		
Sample		Representative	Representative	'Typical'	'Spearhead'	Representative	Typical
Time span		1993-95	1995-96	1994-96	1987-92	1993	1993-1994

1. Case Study 1: Market Scanner for the Installation Sector

A. Preface

Intechnium is the national body for vocational education in the installation sector. Intechnium intends to play an important supporting role in the introduction of new materials and techniques in the installation sector. It is therefore very important that programmes for the transfer of knowledge and skills are offered to the right target group. Innovations can be presented to companies by means of symposia, conferences, demonstrations, training and courses. In addition, Intechnium has an obligation - like any national body for vocational education - to take care of the qualification structure for vocational education (i.e. to establish occupational profiles and curricula).

B. Background to the Project

In 1993, the CIBB was asked to develop a market scanner in co-operation with staff members of Intechnium. The goal of the project was to design and test a permanent research programme which delivers information for setting up an innovation policy in the installation sector. The main question was how to find out at a very early stage which developments will play an important role in the sector in the short, medium and long terms. Developments might, for instance, be new materials, production modes, environment, energy saving, (EC) directives, socio-economic changes and shifts in functions in companies. Intechnium has up-to-date occupational profiles at its disposal, and the market scanner is based upon these profiles.

In addition to the development of a market scanner, Intechnium also needed an instrument for analysing labour-market developments. A third partner was therefore involved in the project (the University of Rotterdam) to develop such a research instrument. The two parts (market scanner and labour-market instrument) were (and still are) combined into one questionnaire. In the description of the case market scanner, we will not elaborate further on the research instrument which was developed by the University of Rotterdam.

The project lasted two years, during which a research project was designed and tested. In this section, we will describe the final outcomes of the project, while the second section will describe the impact of the study.

C. Methodology

The procedure which we developed for the market scanner has three phases:

1 Listing of developments
2 Research (to what extent have developments penetrated installation enterprises)
3 Translation of research results into the annual action plan of Intechnium.

Phase 1: Listing of Developments

The goal of this phase is to obtain actual information on developments in a structural way. In order to obtain this information, a network of experts is created. These experts have to report on developments in the sector and the phase they are in (introduction, growth, maturity, decline). We also asked what the economic importance of the development is, and if it will affect the knowledge and skills necessary for people involved in the sector. An important role for Intechnium is therefore the management of the network: to maintain contact with the experts in such a way that optimal results are guaranteed. In addition, desk research has to yield extra information concerning developments.

When all the information is collected, Intechnium has to select developments which are to be the subject of the research: which developments are to be part of the questionnaire? Firstly, the network members are asked how important a particular development is. Secondly, staff members of Intechnium make a final decision based upon the opinion of the experts, their own knowledge and the long term of a development (for instance, if the expectation is that more enterprises have applied a certain development in comparison with last year, it is important to insert the development into the questionnaire).

The developments are grouped into a number of main topics, such as:

- Electronics in apparatus
- Integrated systems for the regulation of temperature, air-conditioning, fire alarms, illumination etc.
- Design
- Environment
- (EC) directives, regulations
- Materials.

An example of a development within the first theme is: mixer taps which are regulated by electronics are used more often.

Phase 2: Research

The goal of this phase is to find out which developments are so important that they have to be translated into programmes for the transfer of knowledge.

For this purpose, a standardised questionnaire is developed with which general information (part 1) and information on developments (part 2) can be collected. In the first set of questions we ask about:

- The function of the respondent
- The region where the enterprise is located
- The size of the enterprise
- The activities which are performed by the enterprise
- The customers of the enterprise as a percentage of the gross turnover (civilians or project customers, such as new building of houses, maintenance of houses, utility building or maintenance, hospitals, industry, shipbuilding or other).

In the second part, the following questions can be asked for each development:

- Are you acquainted with the development
- Is the development applied in your enterprise
- If so: since when
- If not: when do you think the enterprise will apply the development
- What is the importance of the development in your enterprise (for instance, in the case of the separation of waste on a building site: what percentage of waste is separated)
- For what customers is the development applied, and where do you expect growth over the next five years
- What is the total number of employees in the enterprise who come into contact with the development
- What is the name of the functions which work with the new technology and do they face problems in the field of knowledge and/or skills because of the introduction of the technology.

Not all questions are useful for each development; for instance in the case of electronic systems for ordering, it is meaningless to ask for which customers for which the development is applied.
The total group of enterprise is divided into four subsectors:

- Central heating and ventilation
- Plumbers and sanitary installation
- Engineers, advice and design offices
- Public utility.

For each subsector, it is calculated how large the sample has to be in order to obtain representative results. For some subsectors, it means that enterprises are approached on a regular basis (for instance every two years), while enterprises in other subsectors are only asked once every ten years to complete the questionnaire. Each subsector is scanned every year. A separate questionnaire is prepared for every subsector (some developments are important for one subsector, but not another). The field work is carried out by training advisors of Intechnium.

For the project manager of the market scanner (an employee of Intechnium), this all means that he has to record clearly the enterprises which have already taken part in the research. He also has to instruct and guide the training advisors of Intechnium for their interviews.

When all the questionnaires are completed within a certain subsector in a particular year, the data are entered into the computer and the data analysis can start. This is done using SPSS programs which we have designed. The data analysis has several steps:

- Analysis of errors and eventual recording
- Non-response analysis
- Frequencies of data per development
- Analysis of time series: are there differences in comparison with former years.

Finally, a report is written with the results of the research within the subsector for the year concerned. All the enterprises which participate in the research receive feedback (by means of a summary) from the results of the research. This is a way of motivating them for on-going contributions to the market scanner.

Phase 3: Translation of Research Findings into Programmes for Transfer of Knowledge

The development of a procedure for the translation of research findings proved to be the most difficult part of the project market scanner: how to find criteria on the basis of which one can decide not to do anything at present in the field of transfer of knowledge, when to decide whether a development has to be part of the regular qualification structure for secondary education?

Analysis of the research findings can yield an "interest profile" for each development. Six of these interest profiles can exist for each development:

Interest Profiles per Development			
1	development known	applied	not interested in further information
2	development known	applied	interested in further information
3	development known	not applied	interested in further information
4	development known	not applied	not interested in further information
5	development not known	not applied	interested in further information
6	development not known	not applied	not interested in further information

In this way, the enterprises within a subsector are split up into groups for which an adequate programme for transfer of knowledge can be designed. Enterprises which are acquainted with a development and also apply the development are assumed to have a different need for information (namely training courses) than enterprises which do not know the development and do not apply it (they need information or advice).

The research data can yield extra information in order to discover whether there are differences between the six groups for instance in the size of the enterprise, region, activities, customers etc.

An appropriate programme for transfer of knowledge can now be designed for each interest profile:

- Group 1: no need for extra knowledge or information; the development is no longer an innovation for them
- Group 2: training courses
- Group 3: information with the goal of helping enterprises in their decision-making in implementing the innovation
- Groups 4 and 6: two possibilities:
  - No need for extra knowledge of information because the time is not ripe for it
  - Information with the goal of removing existing prejudices against the development (for instance if the costs of the innovation are much lower than the enterprises think)
- Group 5: information with the goal of introducing the benefits of the innovation to the enterprises.

Our advice was that if more than 50% of the enterprises within a subsector belong to group 1, it is necessary to change the qualification structure (occupational profile and the curriculum for secondary education). If virtually all the enterprises in a subsector belong to group 4 or 6 (no need for extra information), then it is not necessary to incorporate the development into the annual programme (in other words, nothing has to be done as regards the development at present).

Information on innovation which has to reach enterprises is stated up the present time. Eventually, the information has to reach persons working in enterprises. In enterprises where the innovation is already applied, there will be a need for training and the enhancement of knowledge. In the other enterprises, there might be a need for further information. In the literature concerning the implementation of innovation, it is recommended that the decision-making units (DMUs) should be approached. In enterprises, we can distinguish 4 DMUs:

- The purchaser: looks for alternatives, negotiates with suppliers, has a great deal of knowledge on products
- The decider: manager, entrepreneur
- The financier: mostly the same person as the decider, but sometimes also the Ministry of Economic Affairs, or a bank
- The user: the skilled worker who is mainly interested in the convenience of the innovation and its applicability.

Analysis of these groups is important for two reasons:

1 It is a means of determining the most suitable media for the transfer of knowledge
2 Knowledge of the role which people have is helpful to select the information which is most relevant to them.

Finally, an optimal mix of target group (DMUs) and media can be established:

Need for...	**Target group**	**Media**
Training in the use of the product or innovation	purchaser decider financier user	irrelevant irrelevant irrelevant qualifying courses
Information helpful for decision-making	purchaser decider financier user	articles, seminars, demonstrations, workshops articles, seminars, demonstrations, workshops articles, seminars, demonstrations, workshops articles, seminars, demonstrations, workshops
Information helpful for introduction	purchaser decider financier user	articles, demonstrations articles, demonstrations articles, demonstrations articles, demonstrations
Information to remove prejudices	purchaser decider financier user	direct mail, articles direct mail, articles, advice on training direct mail, articles articles

D. Results of the Project

The project Market Scanner lasted two years. Within these two years, research was carried out in all four subsectors. A standardised questionnaire was developed for each subsector. A report containing the results of the research was written for every subsector. An expert network was set up for the four subsectors, statistical programmes for each research were developed, including software for time series, and finally a manual was written in which every step of the process is described in detail.

E. Impact of the Market Scanner

At present, the Market Scanner for the installation sector is still operational. One staff member of Intechnium is occupied full-time with the project. Every year more than 500 enterprises are approached with a questionnaire containing about 25 developments. A description is given below of what has happened as a result of the development of the market scanner.

Some curriculum reforms have been carried out. An example of this is a new government regulation in the field of energy-saving. This rule has considerable impact on the execution of the tasks of some profiles. It was therefore necessary to incorporate this into the curriculum of several profiles. This did not cause any change in the occupational profile, however, because Intechnium has a 'new technologies' module in which new developments are placed. Intechnium uses this module in order to be able to avoid constant time-consuming changes in the occupational profiles. Other developments, such as the introduction of a new heating apparatus, do not force Intechnium to change the profiles and curricula in the short term. It therefore depends on the contents of a development whether profiles and curricula are changed. There is no explicit borderline at 50%. It is possible that the curriculum is changed if fewer than 50% of the enterprises have incorporated a certain development and do not have any need for training or information, as in the case of a government regulation on energy-saving. If many changes have occurred in a particular profile, it might be necessary to perform a new occupational analysis. Until now, this has not been the case. In addition, Intechnium organises courses along with the official qualification structure to give people the opportunity to receive training and obtain knowledge on new developments.

Apart from this, other things have happened as a result of the outcomes of the market scanner, such as the publication of articles in professional journals, demonstrations etc.

An analysis has been made of the quality of the expert network (do all the members give information which meets certain qualitative and quantitative needs). This did not lead to changes, because the quality and quantity were good. The organisation of the network is somewhat more formal than it used to be: an overview is produced by every expert of the developments with which he or she has contributed.

Until now, nothing has been changed in the research instrument, but this year (1997), some important transformations will take place concerning the sample and information gathered at individual level.

With regard to the sample, problems will arise in the smaller subsectors, such as public utility. Originally a random sample was taken, and the enterprises in the sample were controlled: if they had participated the year before, they were removed from the sample and replaced by other enterprises. After a few years of research with random samples in small subsectors, the total population is exhausted. In addition, it was not possible to carry out longitudinal research, because the enterprises in the sample differed every year. In the new design, a more panel-like method is chosen. First of all, a representative sample is taken with all the necessary stratifications (size, region etc.). The enterprises in

the sample are asked to participate in the market scanner for three years. Every year, part of the panel will be replaced by fresh blood. Major advantages of this new method are:

- The enterprises in the panel will not have to complete a huge questionnaire every time, as some questions only need to be asked once
- It is much easier to observe changes within the enterprises
- For the smaller subsectors in particular: enterprises are not asked to participate in the research every two or three years, and the risk of enterprises becoming weary and consequently refusing to participate is diminished
- The enterprises know much better what is expected of them.

In the original framework of the market scanner, only data on the level of the enterprise were collected. This is now regarded as a major shortcoming of the project by the policy-makers at Intechnium. They increasingly want information on an individual level such as:

- That are the strategies adopted by the employers to find new personnel if the enterprise grows: will they hire apprentices or are they more interested in trained professionals?
- With regard to a particular development: why does one profile obtain new tasks and why are there no changes for another profile?
- Why is enterprise x very innovative and enterprise y not?
- More information with regard to the development of individual professional careers of professionals within companies.

This means that the research questions have changed, and therefore that the questionnaires have to be changed. Priorities have to be established in the developments which are selected for the research. Some developments will be examined only at a very superficial level, merely to discover whether the introduction of the developments shows any stagnation (questions such as: is this development applied in your enterprise, since when, how often?). Other developments will be examined in depth: what are the bottlenecks in working with the innovation, what has improved as a result of the innovation and what has deteriorated, what is the need for knowledge and skills as a result of the introduction etc.

This information is needed to optimise Intechnium's policy in the field of occupational profiles and curricula, courses and all other activities which Intechnium performs in order to be an innovative national body for secondary education.

In summary, we may conclude that the market scanner research instrument, developed for Intechnium, has already yielded relevant information with regard to the formal tasks of the national body, but has also produced information with which Intechnium can play a role in the innovative strength of the installation sector.

However, the information to date had been too superficial. The project therefore not only had results with regard to actions undertaken by Intechnium, but has also gradually led to the realisation that the research method has to be improved, as described above, in order to gain more profound and relevant information for policy-makers.

2. Case Study 2: 'Occupational Analysis' in the Field of Inland Navigation

A. Preface

In 1995 the CIBB carried out an occupational analysis on behalf of the national body for inland navigation. In the first section we will describe briefly the place of a national body within the field of secondary vocational education. In section 2 we will pay attention to the research project. The final section will contain a description of the impact of the research on education.

B. The System of Secondary Vocational Education in the Netherlands

In January 1996 the WEB[2] (Secondary Vocational Education and Adult Education Act) became effective. This new law guarantees more coherence between different types of education. In August 1997 the new qualification structure for vocational education as described in the WEB will start. This means that the old structure will be abandoned and the new types of education will be introduced. This new structure can be described as follows:

Situation from August 1996	Old situation
Education on four different levels: - assistant (level 1) - basic vocational (level 2) - vocational (level 3) - middle management (level 4) - specialist (level 4) For these 4 levels, two types of education are distinguished: - day-release education for young employees (comparable to former apprenticeship) - vocational training (comparable to former vocational schools)	Full-time secondary vocational school: - short variant - long variant Apprenticeship: - primary level - secondary level - tertiary level - guidance and intermediate education

Each type of education consists of subject certificates, optional or compulsory.

The national bodies for vocational education play an important role in the WEB. For each branch of industry, group of branches or category of professions, they formulate the curricula for vocational education. These curricula have to be based upon occupational profiles, which have to be approved by a committee of representatives of employers, employees and vocational schools.

2 Abbeviation for Wet Educatie en Beroepsonderwijs

An occupational profile has to meet the ensuing demands:

- A profile is a characterisation based upon the classification criteria:
  - Responsibility
  - Complexity
  - Transfer
- A profile contains clusters of consistent professional activities
- The activities within the cluster:
  - Are a meaningful, logical and necessary part of the profession
  - Can be carried out by one person
  - Are aimed at a productive goal

- A profile contains an enumeration of specific instruments/tools/machines and specific conditions (work situation).

The classification criteria are specified as follows:

- Responsibility:
  - Own job responsibilities
  - Collective/co-operative
  - Hierarchical
- Complexity:
  - Automated routines
  - Standard procedures
  - Combining standard procedures
  - Development of standard procedures
- Transfer:
  - Skills and knowledge are attached to function
  - Skills and knowledge are attached to occupation
  - Skills and knowledge are independent of occupation

On level 4, two function types are distinguished: specialist and middle management. This distinction is made because the contents of the work of both functions is rather complex, with a fairly high degree of transfer, but on the other hand the function of middle management is hierarchical, while the specialist has his own job responsibilities or works in a collective/co-operative way.

This new classification structure is connected to the SEDOC classification, so that international mobility is stimulated.

Because of the new classification criteria, and because profiles were outdated, the national body for inland navigation at that time (now merged into the national body for transportation and logistics) commissioned research from the CIBB for an occupational analysis in the field of inland navigation. This project started in February 1995 and was completed in November 1996. The method used for occupational analysis used in this project and the outcomes of the study will be described in the next section.

C. Description of the research method

In many occupational analyses, the CIBB uses a method known as 'Mantelproject'. The Mantelproject is a very comprehensive and widely applied method for the analysis of occupations at professional, technical, skilled and semi-skilled levels. Central to this approach is the description and measurement of the actual activities which workers in certain occupations perform. Another important characteristic of this method is that the result is not a description of a single occupation, but an overview of many occupations within a job family.

The method was developed in order to collect detailed information on the professional structure within a certain field and on the contents of each profession within this structure. The results of the research can be translated into curricula for the benefit of vocational education. A curriculum provides information on the knowledge and skills someone needs for good job performance.

The Mantelproject provides information with which it is possible to compare several occupations: what are the similarities and differences between the tasks which people perform and what are the requirements for the jobs? Some activities could be performed by almost anyone, while other tasks form part of the job responsibilities of only a few people.

The method consists of several steps:

- Orientation;
- Construction of a questionnaire which consists of two parts:
    - General questions about the job-holder (experience, education etc.), the company in which he works, the name of the function, etc.
    - A detailed list of activities which a great variety of job-holders has to complete; for each activity the job-holder has to indicate whether he carries out the task and - if so - how frequently this happens and what importance he attaches to the activity;
- Validation of the questionnaire by a group of experts;
- Taking a test sample;
- Survey among a large group of workers within the occupational field;
- Statistical analysis:
    - Cluster analysis: after the data have been entered into a computer, they are grouped on the basis of correlation between activities. The result of the cluster analysis is therefore a group (mostly 20 or more) of clusters of coherent activities;
    - Profile analysis: using statistical software, it will be analysed what internally coherent job profiles can be distinguished. A profile is a description of an occupation based on the activities carried out. These profiles provide an insight into the diversity of the various jobs, and their differences and similarities;
- Validation of the statistical outcomes (clusters and profiles) by a group of experts.

D. Vocational Analysis in Inland Navigation

In October 1994, the national body for inland navigation set up the Education & Trade and Industry Comittee. This committee is responsible for the development of the qualification structure for inland navigation. The qualification structure must be based upon occupational profiles.

Until that time, the educational structure had only two directions: the training for sailors and that for ship's masters0 (owners of ships). There was no profile for the ship's master, while the profile for the sailor did exist, but was unsatisfactory. We also suspected that there were more profiles in this field than these two.

The CIBB was asked to carry out an occupational analysis and poduce profiles as the basis for a new qualification structure. The assignment had two restrictions:

- Occupations with specialised tasks for the (maintenance of the) engine room were not involved in the research
- Passenger ships were excluded from the research as well, because the activities in this sector differ too much from those in the transportation of goods.

The research was guided by a supervory committee, whose members were delegates of the CET (Eduction & Trade and Industry Committee). It met at various stages during the project:

- At the start of the project (goals and method of the research)
- After completion of the questionnaire (establishment of the questionnaire)
- After the profile analysis
- At the end of the research project (to decide upon the final report).

This supervisory committee was responsible for the research process and outcomes. It was not responsible for the final establishment of the profiles, nor for the curricula.

The actual field work took place in July 1995. Before the field work started, a representative sample was taken, with the necessary stratifications:

- Division into subsectors (large bulk, tankers, push-towing and container ships)
- Division in terms of size of ship: one/two persons or more than two
- Division in terms of function: sailor/navigating officer or captain/ship's master

A total of 254 persons working on inland navigation vessels weren interviewed. The results of the study were found to provide a represenstive picture of the total population.

The questionnaire consisted of two parts:

1 Background questions:
- On the enterprise (size of the ship, number of crew members, push-towing /container / tanker / dry bulk, type of cargo, single-ship owning company or larger ship owner etc.)
- On the respondent (age, experience, education etc.)
- On the function (degree of autonomy of the function, executive function or not etc.).

These background questions are necessary for the identification of the occupational profiles and serve as an explanation for differences between profiles.

2 List of activities:

The researchers studied existing profiles and other relevant literature in order to obtain a broad overview of the kind of work which is carried out on a ship. This information was put together into a list of fields of activity. With this list, the researchers subsequently visited different ships in harbours and near locks, in order to interview the crew. These persons were asked what their work implied, what their activities were during the day, from the moment they woke up until the moment they went to bed. With the results of the interviews, the researchers were able to construct a detailed list of activities which are performed in inland navigation. This list was discussed with experts and with the supervisory committee. This resulted in a list of 429 activities, divided into 31 chapters and 37 instruments/tools which might be used. An example of a chapter with activities is shown below. Aspects concerning (European) legislation were also included in the list. In the research, no questions were asked on qualification needs, but questions were asked on the activities which crew members perform[3].

Do you perform activities in the field of anchoring?	0 yes (fill in activities below) 0 no (continue at section 5)		
		frequency	importance
1 I operate the anchor winch	N	1 2 3	1 2 3
2 I drop the anchor	N	1 2 3	1 2 3
3 I check whether the anchor holds	N	1 2 3	1 2 3
4 I check that the ship does not break adrift during stormy weather	N	1 2 3	1 2 3
5 I haul the anchor	N	1 2 3	1 2 3
6 I work the anchor signals	N	1 2 3	1 2 3
7 I operate the anchor lights	N	1 2 3	1 2 3
8 I check the anchor lights	N	1 2 3	1 2 3
9 I give instructions during anchoring	N	1 2 3	1 2 3

3 One criticism of the Mantelproject is the somewhat conservative approach of the method: Job-holders are asked about their current work, and not about future developments. This produces a rather static picture of the field. The national body initially envisaged commissioning a study on future developments in the field which were to take place when the profiles were settled. In order to be sure that the profiles were up to date, the researchers included all new technologies and tools which they could think of in the questionnaire. However, the research does not of course provide an answer to the question as to what is going to happen in the future. The study for future analysis has not as yet been carried out. It is unknown whether the national body has plans in this direction in the near future.

Frequency: N = never
1 = once a week or less
2 = more than once a week - once a day
3 = more than once a day

Importance:
1 = less important
2 = important
3 = very important

During the analysis phase, the scores on frequency and importance are combined into a "W-score" (Weight), according to the following matrix:

importance / **frequency**	less important	important	very important
never	0	0	0
once a week or less	1	4	7
> once a week - once a day	2	5	8
> once a day	3	6	9

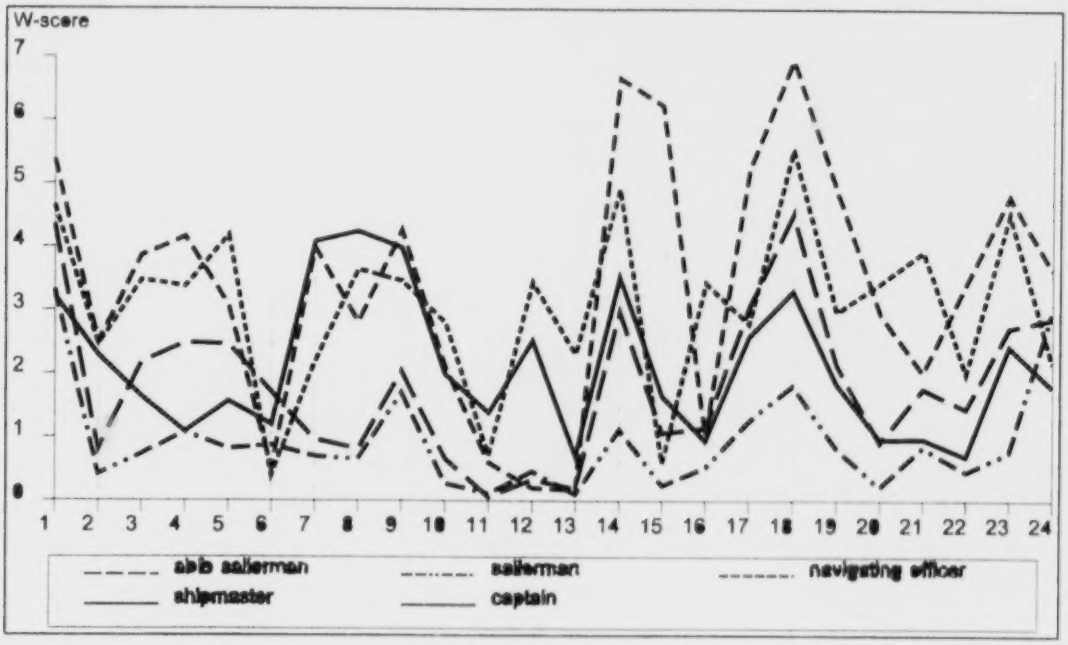
The further statistical analysis (clustering, profile analysis) is based upon the W-score. During cluster analysis, it is calculated which activities have the highest correlation. The result is a dendrogram. These dendrograms are discussed with experts in the field. This resulted in 24 activity clusters:

1 Manoeuvring
2 Navigation
3 Making the ship ready for sea / for storm
4 Making fast/unfast
5 Anchor
6 Coupling/uncoupling (in push-towing)
7 Executive tasks
8 Ship's papers
9 Communication
10 Stock-keeping
11 Personnel management
12 Financial/economic management
13 Chartering
14 Loading/unloading in general
15 Loading/unloading tanker
16 Loading/unloading dry bulk ship
17 Calamities
18 Safety
19 Environment
20 Lifeboat
21 Repair/maintenance
22 Tackle (ropes)
23 Engine room
24 Household.

After the cluster analysis, the profile analysis took place. For each respondent, it is calculated what his mean score is on the 24 activity clusters. In this way, an individual profile for each respondent is obtained. The individual profiles which are statistically most similar are combined into an occupational profile. This resulted in 5 different occupational profiles:

- Sailor
- Able sailor
- Navigating officer
- Ship's master/entrepreneur (owner of one ship)
- Captain (in the pay of a larger ship owner).

The final step was to combine these profiles with the background data. These final results are approved by the research supervisory committee (representatives of national body, schools and companies - not the Education & Trade and Industry Committee). The main characteristics of the five profiles are shown in the graph below.



Sailor

The sailor has the lowest profile of all. This means that respondents within this profile have the lowest W-score on the activities in most clusters. The most important tasks of the sailor are: manoeuvring, communication, safety and housekeeping. This is a rather complex profile, because it in fact consists of two completely different groups: one group consists of young people with little work experience and the other part consists of bargemen's wives, who often assist in the family business (on the ship); they often possess the necessary certificates for sailing with a ship and often have as the housekeeping as their main task.

Able Sailor
An able sailor appears very similar to the sailor, but has higher W-scores on every activity cluster. This profile consists of men only, with average working experience of 6 years in inland navigation. Their most important tasks are: manoeuvring, loading/unloading in general, calamities, safety and housekeeping.

Navigating Officer
This profile differs from the previous two in some respects, among others because of the far higher W-score on the clusters of loading/unloading in general, loading/unloading tankers, executive tasks, communication, navigation, safety and engine room. They have average working experience as a navigating officer of 6 years and have obtained the most important diplomas for inland navigation. They usually work on larger ships.

Ship's master/Entrepreneur
The ship's master/entrepreneur is the owner of mostly one small ship. Almost all these ship's masters sail with their wives on board as assisting partners. Because these ship's masters are the owners of the ships, and therefore responsible for the exploitation, they have the highest W-scores on the clusters of chartering, ship's papers and financial/economic management. The average number of crew members is low (sometimes they only sail with their wives), and the W-scores on executive tasks and personnel management are therefore not as high as for the navigating officer or the captain. The ship's master has many tasks that are performed by (able) sailors/navigating officers on larger ships, such as anchoring, manoeuvring, loading/unloading, engine room and repair/maintenance.

Captain
This profile is found on larger ships. His main tasks are executive tasks, ship's papers, communication, loading/unloading and safety. This profile has the highest W-score on the cluster of personnel management. The captain is not the owner of the ship, but the employee of a ship owner with more ships. This ship owner usually arranges the cargo, contracts etc..

E. The Impact of the Research

i) Impact
In November 1995, the occupational profiles were presented to and approved by the supervisory committee for the research. At this point, the role of the CIBB was finished. The national body for inland navigation, in this case the CET (Eduction & Trade and Industry Committee), was responsible for the final establishment of the profiles and - afterwards - the curriculum. This proved to be a very difficult task.

One of the first conclusions of the CET was that the profiles of the sailor and that of the able sailor did not differ materially from each other. The able sailor is someone with more working experience, and therefore performs more tasks. The CET saw no reason to develop two different curricula for the two profiles, since experience is not something

one can learn at school. The profile of able sailor was therefore set aside. The problem which arose as a result of this decision was the functioning of the labour market. Working in inland navigation is a hard life. An average journey (to Belgium, France or Germany) takes about a week, while a voyage to Switzerland takes as long as two weeks. All that time, the personnel are away from home. The ships are small, and people see each other all day. Severe problems arise if they cannot get along with each other. Working days are long, and much of the work is routine. This is the reason why employers find it very difficult to hire personnel.

A few years ago, it was possible to hire unqualified sailors. After a few years, they obtained a diploma based on their experience in inland navigation, not on education. A new law for personnel in inland navigation forced employers to hire only sailors with a diploma. And these people are scarce. After a long consultation process with the government, a solution was found in the "sailor-with-dispensation". Employers are since been allowed to hire sailors without a diploma. This dispensation is valid for one and a half years. Before they are allowed to sail, they have to go to school first to acquire four fundamental subject certificates. This takes about 8 months. After this period, they are allowed to work as sailors. They are obliged to continue their training as sailors during the dispensation period.

To sum up, the new profile of the sailor is a combination of the original sailor and able sailor. The new name for the remaining profile is 'sailor'. In general those activities of the former two profiles which are performed by more then 55% of the profile holders are included in the new profile of sailor. The reason why this percentage is chosen is not clear, but we have the impression that it is based upon common sense: what knowledge and skills do employers expect from sailormen. Some activities are excluded from this profile and placed in profiles of higher functions. The main reason is the amount of technical knowledge for correct performance of the task. For instance, even though 78% of the able sailors in the research steer in the evening with the help of radar, this activity is no longer part of the profile of sailor, but is now part of that of the navigating officer.

One profile, however, differs from a curriculum: in an occupational analysis it is not asked what the qualification needs for a function are, but it is asked what activities someone performs. Although the profiles of the research and the final profiles as decided upon by the CET look very much alike, the curricula differ from them in many respects. The main reason for this is that activities which have a high correlation and therefore occur in coherence should not - from an educational point of view - be part of the same subject certificate.

For instance, one of the subject certificates is nautical techniques 1. Basic knowledge and skills in the field of manoeuvring, making fast/unfast, preparing the ship for sea/for stormy weather, and maintenance are included in this certificate. The more difficult knowledge and skills from these activity clusters are placed in the certificate for nautical techniques 2. In addition, new knowledge and skills (not part of the research) have been included in the curriculum, such as: 'the trainee can understand simple oral German texts, such as radio messages (weather, obstructions) and messages through the mariphone. Another example of an educational goal is: the trainee can apply for a function. This was of course not based on activity within the research.

During the development of the curricula, the profiles have been altered. The main reason for this was that activities which were part of the same cluster were not of the same degree of difficulty. Some activities were placed in the curriculum for the sailor, others in the higher curricula. Other activities such as communication were part of the original (research) profiles but were deleted by the CET (these activities are, however, part of the curricula).

The discussions in the CET sometimes resembled collective bargaining, because the employers and the employees are members of this committee. Employers have an interest in low pay, and therefore in personnel who are not overqualified (the more education, the higher the pay). That is why the employers have been keen on the dispensation for starting sailors and the rather low level of difficulty and short duration of the training for sailors. Employees, of course, have the opposite interest.

The profile of navigating officer has been named 'navigating officer/ship's master' by the CET. The original profile of ship's master is combined by the CET with that of the captain and is given the new name 'captain'. The reason for this is not clearly to be found in the minutes of the meetings of the CET, but according to staff members of the national body, some employers thought it was impossible to explain to their rank and file why the name captain was replaced by the name ship's master. To the recollection of these staff members, the discussions on this subject were above all very protracted and confusing. The curriculum for the new profile captain is partly based on the research, but partly also on the European guidelines for entrepreneur in inland navigation and on (Dutch) regulations for skills for entrepreneurs in small and medium-sized enterprises.

The last profile which is part of the new qualification structure is that of the boatswain. It has not been a subject of the research. On the contrary, it is an old profile which was reaffirmed by the CET. Boatswains work in the harbour; they rope one ship to another, for instance to tugboats or to mooring-posts. They manoeuvre with very small boats between one ship and another. Another task is helping sea-going ships to enter the harbour.

The final profiles were established by the CET at the end of February 1996. The curricula for the four were developed by the national body and confirmed by the CET in May 1996. The new qualification structure is shown in the table below.

	Sailor	Boatswain	Navig. off. ship's master	Captain
Communication inland navigation 1	x		x	x
Communication boatswain		x		
Basic skills inland navigation	xd	x	xd	xd
Loading/unloading 1	xd		xd	xd
Nautical techniques 1	xd	x	xd	xd
Basic skills safety	xd	x	xd	xd
Nautical techniques 2	x	x	x	x
Loading/unloading 2	x		x	x
Repair and maintenance	x	x	x	x
Ship mechanics inland navigation 1	x		x	x
Ship mechanics boatswain		x		
Coupling/uncoupling (in push-towing)	**		**	**
Navigating/manoeuvring a flat		x		
Boatswain techniques		x		
Working on a sea-going ship		x		
Dredging	**		**	**
Communication inland navigation 2			x	x
Exact sciences			x	x
Ship mechanics inland navigation 2	**		x	x
Operation of a ship			x	x
Navigation / manoeuvring			x	x
Loading/unloading 3			x	x
Transportation dangerous substances			x	x
Radar			x	x
Basic certificate mariphone		x	x	x
Personnel and organisation				x
Financial administration				x
Entrepreneurship				x
Ship-building and equipment				x

x = compulsory
xd = subject certificate necessary for sailor-with-dispensation
** = optional

The level of the 4 types is (see also section 1):

- Level 2 (basic vocational) for sailor and boatswain
- Level 3 (vocational) for navigating officer/ship's master and captain.

No level 4 functions are distinguished, because the work in inland navigation is not very complex.

At present, the schools and the national body are developing educational materials for these four qualifications. In August 1997, the new qualification structure will start and aspiring sailors/navigating officers etc. from that time on will receive training which is based on the new curricula.

ii) Conclusion

The conclusion which we can draw from this is that the findings from research are not copied for the sake of curriculum development, partly because a curriculum is something other than a profile and the activities and cluster belonging to a profile need to be re-arranged in order to develop a coherent and logical curriculum.

However, another reason for all the changes is the legal obligation that employers as well as employees must be members of the CET, which is responsible for the profiles and the curriculum.

Staff members of the national body altogether are very happy with the new profiles and curricula, because they reflect daily practice the inland navigation. The old curriculum for the sailor in particular was far too theoretical.

The research - as a final conclusion - was helpful to the development of curricula, but not decisive.

3. Case Study 3: 'Qualification Analysis' for Revision of Initial Training for Motor-Vehicle Mechanics

A. Preface

Case study 1 investigates a development project within the motor-vehicle mechanic vocational education scheme in Denmark. The context of the case study is the Danish vocational system, to which a brief introduction will be given below.

B. The Structure of the Danish Vocational System

Initial vocational education in Denmark is dual training. Each vocational education scheme consists of periods spent at technical schools - the school periods - and periods spent at the enterprises - the training periods. Each apprentice has a contract with an employer, who is responsible for the apprentice's in-company training periods.

The objectives for initial vocational education and training are laid down at a national level by the Ministry of Education in curriculum regulations. The curriculum regulations prescribe the aims which should be achieved for each vocational education and training period. Since 1991, the general objective for all vocational education has been to have few and broad education schemes. Within this overall objective, the Ministry of Education follows the recommendations of trade committees when legislating or amending curriculum regulations.

The trade committees are responsible for the content and duration of vocational educations. The committees consist of an equal number of representatives from the social partners. The responsibility and initiative concerning curriculum development therefore rests with the social partners. It is consequently also a task for the trade committees to anticipate industrial change.

The trade committees usually conduct inspections of the vocational education schemes every 6 or 8 years. These investigations take the form of either conferences for the industry or analyses of future needs for vocational qualifications. The trade committees often involve external expertise when surveying the vocational education schemes. In Denmark, the Danish Technological Institute (DTI) has specialised in this type of analyses and surveys. The DTI has surveyed future needs for qualifications in various industries and vocational education schemes using industrial sociological analysis.

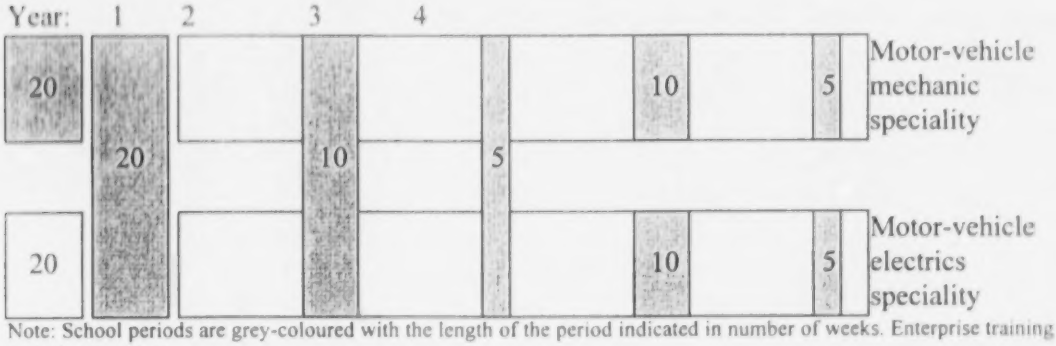
Initial vocational education takes place at technical schools. The technical schools are free to choose their own educational practices, as long as the national objectives are followed. At each technical school, the social partners are represented in local educational councils. The social partners consequently have influence over curriculum plans at national level and educational practices at local level.

For elaborate descriptions, the reader should consult the Danish sector reports on certification[4] and instruments and tools for anticipating industrial change[5]

C. The Structure of the Danish Motor-Vehicle Mechanic Vocational Education

Initial vocational education for motor-vehicle mechanics is a four-year dual training scheme. The apprentices alternate between school-based learning and training at enterprises. Objectives for both school and training periods are given in the curriculum regulations. The scheme has two specialities: the motor-vehicle mechanic speciality and the motor-vehicle electrics speciality.
In 1994 the scheme had the following structure:

Figure 1: Structure of the Motor-vehicle Mechanic Vocational Education scheme in 1994.



Note: School periods are grey-coloured with the length of the period indicated in number of weeks. Enterprise training periods are white.

Apprentices have two ways of entering the training scheme: they can enter the first school period of 20 weeks or they can substitute the first school period with 20 weeks of general work experience. The second school period lasts for 20 weeks and forms the common basis for the two specialities. To be able to start on the second school period, each apprentice has to have a training contract with an employer. After the second school period, each apprentice chooses between the motor-vehicle mechanic and motor-vehicle electrics specialities. The motor-vehicle mechanic speciality is by far the most important speciality, see Figure 2, and is the main reason as to why the motor-vehicle mechanic training scheme is one of the most popular and largest initial vocational education schemes in Denmark.

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4 Systems and procedures of certification of qualifications in Denmark, DTI Human Resources Development, Taastrup 1992.
5 Instruments, tools and policies to anticipate the effects of industrial change on employment and vocational qualifications (ITS) - country report Denamrk, study for the European Commission - DG 5.

Figure 2: Number of Training Contracts between Enterprises and Apprentices

	Motor-vehicle mechanic speciality	Motor-vehicle electrics speciality
1995	1310	35
1994	1163	27
1993	1058	22

Source: The trade committee for motor-vehicle mechanic vocational education

D. Background

At the beginning of the 1990s, the motor-vehicle repair and distribution sector in Denmark was aware that changes were needed in the industry's vocational training schemes. The tasks performed by mechanics had changed dramatically over the past decade, as had the demand for changed and new qualifications. Against this background, both the employers' federation and the Metal Workers' Union agreed that there was a need for educational changes.

During the 1980s, the motor-vehicle repair and distribution sector in Denmark as well as in Europe had undergone structural and technological changes. The market conditions had changed, quality in service concepts had become more and more important etc. In some countries, this prompted structural changes in the enterprise size and distribution of motor-vehicle repair and distribution sector, but in Denmark the results of change to a greater extent took the form of a change in the structure of motor-vehicle mechanic jobs.

The main reason for the change in motor-vehicle mechanic jobs was technological. In a few years, the passenger car had changed from being a purely mechanical object to a high-tech item. The number of electronic parts in passenger cars was steadily increasing, thus creating new tasks of high complexity. The 'arrival' of high-tech cars therefore resulted in new qualification demands for motor-vehicle mechanics.

The trade committee was aware of these changes becase of at least three sources of information:

1. A conference for the motor-vehicle repair and distribution sector in 1992.

This conference was a joint initiative between the social partners. The purpose was to discuss trends in work organisation, training and education etc. At the conference, there was input from the Swedish company VOLVO, which can be characterised as a 'spearhead' enterprise.

2. The FORCE project 'Employment, Work and Training in the European Motor-vehicle repair and Distribution Sector'[6] including the Danish contribution[7].

The Danish sector report, which was completed in 1992, is based on four case studies. It concludes that radical changes are taking place within the Danish motor-vehicle repair and distribution sector. The changes concern:

a) Customer service and the enterprises' use of quality concepts
b) Changing work tasks, work organisation and qualification demands due to technological changes

The results of the FORCE project was presented at an international conference in which the Danish social partners participated.

3. The report 'Educational Structure within the Motor-vehicle repair and Distribution Sector' by the Motor-vehicle repair and Distribution Sector Employers' Federation[8] (the MAF brief).

This report was the result of an initiative taken by the employers' federation. The paper was discussed by the social partners on the trade committee.

On the basis of the MAF brief and under the effect of general conclusions from the above reports, the social partners agreed that there was a need to do something about the motor-vehicle repair and distribution sector's vocational education schemess. The partners agreed to the need for changes in the content and structure of the education.

The social partners in the trade committee decided that they needed more in-depth and specific information concerning the future needs for vocational qualifications[9]. They therefore decided that a qualification analysis should be part of the information base for a renewed education scheme.

In the early spring of 1994, the trade committee established a steering committee and then asked the DTI to conduct the analysis. The social partners each appointed three members to the steering committee. The members all worked in the motor-vehicle repair and distribution sector; either as managers or mechanics. There were no school representatives or educationalists in the group.

The secretary of the trade committee was appointed secretary of the steering committee. He had to ensure that the process was on-going and co-ordinated, that the legislative rules and framework were followed, and finally he had to document decisions taken by the steering committee.

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6 'Employment, Work and Training in the European Motor-vehicle repair and Distribution Sector', Task Force Human Resources - Education, Training and Youth, September 1993. This study is partly a synthesis of 10 national sector studies.
7 FORCE - Automobile Study, The Dansih Contribution: Autobranchen i Danmark - Draft report, DTI Human Resources Development, Taastrup 1992.
8 Motorbranchens uddannelsesfond - Rapport for MAF's arbejdsgruppe, Oktober 1993. This report exists only in a Danish version.
9 According to Jørgen Madsen, Secretary of the Trade Committee for Motor-vehicle Mechanic Vocational Education.

E. Methodology

In the spring of 1994, the DTI consultants began their analysis. The analysis project had three main steps.

1. Problem identification

The consultants were the same two persons who had undertaken the FORCE study in 1992. They were therefore familiar with the background to and the focal points of the analysis.

2. Statistical description of the Danish motor-vehicle repair and distribution sector

This work was carried out in the early summer of 1994 and was essentially an update of parts of the Danish sector report in the FORCE project. The results of the statistic description were recognised as a first milestone. The results were therefore presented to the steering committee at a meeting.

3. Case studies at 20 enterprises

The 20 enterprises were chosen according to criteria such as size, 'single-make or all-round repair shop', location etc. This was done to in order to ensure a broad picture of trends in the industry.

The case studies were based on personal interviews with middle managers and motor-vehicle mechanics at each enterprise. Two different semi-structured questionnaires were used, one for mechanics and one for management. They focused on tasks, technology, qualification demands and work organisation. The questionnaires focused on new and changing tasks such a fault-tracing and did not include a full list of task descriptions. In this way the analysis focused more on future demands than on 'qualification gaps'.

The interviews showed that management and workers sometimes had differing perceptions and views on the constituents of a working day. It also showed that some managers worried that not all mechanics would be capable of learning to trace faults in electronic systems and therefore wanted to let specialists undertake these tasks. The mechanics themselves had more confidence that they would be capable of undertaking future jobs including fault-tracing tasks.

The consultants supplemented the interviews with observations of work organisation and the physical arrangement of the motor-vehicle repair shops.

After the first 10 interviews, the consultants presented their results to the steering committee. All participants agreed that the project was on the right track, and the last 10 interviews were then conducted.

In the early autumn of 1994, a report was prepared, and it was presented to the steering committee at a seminar in October 1994.

F. Results

The DTI report contained four main conclusions:

1. The qualification profile of the existing motor-vehicle mechanic vocational education did not match the present qualification demands of the motor-vehicle repair and distribution sector.

2. Service and repair tasks on auto-electronic systems were of increasing importance. Mechanical tasks were of decreasing importance.

   One of the most important future qualification demands would be the ability to trace faults in electronic systems. It was also pointed out that there was in general a need to emphasise theoretical understanding of (electronic) systems instead of focusing on manual skills.

   The report mentions and describes in detail some qualifications demands which are essential. Twelve demands for technical skills, six for general skills and three demands for personal skills are described.

3. The future job profile for Danish motor-vehicle mechanics will be broad - not specialised.

   Because of the Danish enterprise structure with many small, all-round repair shops, the future demand will be for broadly skilled mechanics - not specialists.

4. Competence development could increase if learning processes in schools and in enterprises were closer co-ordinated with respect to the educational objectives.

   This was especially due to the fact that some enterprises did not seem to take their responsibility towards educating apprentices seriously enough.

So far, the analysis had the following steps:

Figure 3: Project Steps of the Qualification Analysis in 1994

April	May	June	July	September	October
Problem identification	Statistical description	Meeting	First 10 case studies	Meeting	10 case studies	Analysis	Results	Seminar

G. Impact

i) Curriculum Development

When the DTI consultants presented their report to the steering committee, another group of six persons was present. This group was called the curriculum development (CD) group, and its members were appointed by the steering committee. The objective of the CD group was to 'transfer' and integrate the results of the DTI report into the curriculum development by rewriting the curriculum regulations for the motor-vehicle mechanic vocational education.

The CD group members were appointed by the social partners on the basis of their practical experience from the motor-vehicle repair and distribution sector. Like the members of the steering group, they were all managers or mechanics. There were no school representatives or educationalists in the group. The secretary of the trade committee was appointed secretary of the CD group. He had to ensure that the group respected the legislative framework, and was to co-ordinate the development process.

The CD group and the secretary met twice. The first meeting took place in January 1995. Both meetings were arranged as two-day workshops designed for intensive work. The DTI report was read by all members of the group, and the results were discussed in the group. The main conclusions were then transferred into the curriculum work. However, the detailed descriptions of qualification demands were not transferred directly into the curriculum. The CD group instead defined the educational objectives themselves. The group first decided on three objectives:

A) The education should focus more on new tasks such as fault-tracing

The members of the group kept asking one question: *Which tasks is an apprentice to be able to perform at various stages in his/her education?* Each time they agreed on a precise description of a task, they defined the qualification demands for that task.

B) The length of each school period was to be shortened, but the total length should be unchanged

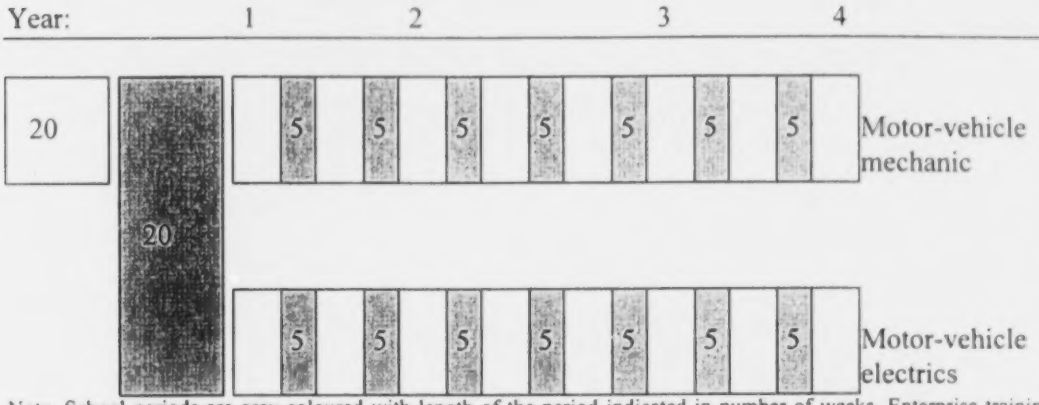
This objective was due to a general impression that apprentices are bored with the long school periods, and that shortened school periods would produce more effective learning processes. There was no written documentation for this but a large amount of local evidence in oral form.

C) Each school period should result in the apprentices' ability to perform certain tasks

At an early stage, the group decided that the new structure was to be clear and easily understood for the schools, the apprentices and the enterprises.

The group ended up suggesting a changed educational structure, as shown in Figure 4.

Figure 4: New Structure of the Motor-vehicle Mechanic Vocational Education



Note: School periods are grey-coloured with length of the period indicated in number of weeks. Enterprise training periods are white. There are two specialities - the motor-vehicle mechanic and the motor-vehicle electrics speciality.

The new scheme differed from the old structure in the following ways:

- The content of the education emphasises work on motor-vehicle electronic systems and the development of general skills
- The first school periods are reduced from 40 (2 x 20) to 20 weeks
- The school periods have a length of only 5 weeks - but total length is unchanged
- The apprentice makes an early choice of speciality - after the first school period
- Specific objectives are described for each school and training period

ii) Legislation of Curriculum Regulations

In March 1995, the curriculum development was completed, and the new curriculum plan was sent to the Ministry of Education. The Ministry found that the new structure conflicted with general ideas in the vocational educational system. In their view, the early specialisation conflicted with the overall political intention of creating broad vocational education schemes for young people. In the following months, the trade committee tried to convince the civil servants in the Ministry that the new structure was adequate. The new curriculum regulation was finally enacted and passed in December 1995. The motor-vehicle mechanic vocational education scheme now has a new structure and content.

iii) Information Campaign

While the legislative work was still in progress, the trade committee prepared a campaign, which had two objectives:

- To inform technical schools, enterprises and local social partner representatives about the new educational structure

- To explain to the enterprises what the trade committee expects from them when they have apprentices

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For this purpose, a booklet was produced containing the objectives for each school and training period. The objectives are listed very briefly and in a form which makes it very easy to see which tasks the apprentices should be able to perform at various stages of their education. The booklet was sent out to the 3,500 enterprises certified to have apprentices in December 1995.

By reading the booklet, the enterprises would know what they were expected to teach the apprentices at various stages. They would also know what the apprentices should be able to do on returning from training at the technical schools.

The trade committee also conducted a series of regional information meetings. In January-February 1996, 7 meetings were held at technical schools throughout the country. Both social partners from the local educational boards and representatives of the technical schools were present. At the meetings, the trade committee informed the participants about the new structure and objectives and elaborated on the committee's intentions with the new scheme.

In June 1996, 6 meetings were held for the enterprises. Every fifth enterprise certified to have apprentices took part in the meetings.

The secretary said about the meetings that *'the actors were told what we expect from them - what was important for us...I think we have changed the perception for all the actors ...and they were pleased with both the results* (the new educational structure) *and the process'.*

Appendix 1: The Four Steps from Analysis to Information Campaign in Case Study 3

	Analysis	Curriculum Development	Legislation	Information campaign
Agents of change	Trade committee (Social partners)	Trade committee (Social Partners)	Trade committee (Social Partners)	Trade committee (Social Partners)
	DTI consultants	Group appointed by the social partners	Ministry of Education	
Method	Qualifications analysis Case studies	Educational objectives described from work situation objectives	Juridical	Booklet Regional information meetings
Time	March-November 1994	January-March 1995	March-December 1995	December 1995-June 1996

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4. Case Study 4: Action Research for Job Improvement in the Plastics Industry

A. Preface

This case shows how qualification analysis can result in the development of continuous vocational training courses which may support the development of work organisations, thus enriching jobs.

The main actors in this case are the Continuing Vocational Training (CVT) committee in the plastics industry, DTI Human Resources Development, two enterprises in the plastics industry and the AMU system.

The CVT committee, which consists of an equal number of social partner representatives, is responsible for the development of continuous vocational training (AMU courses) for unskilled workers in the plastics industry.

The AMU system is a labour market training system which has traditionally made use of qualification analysis results. It is governed by the Ministry of Labour and conducts vocational training through AMU centres spread across the country. It was established in 1960 for semi-skilled workers, and offered courses to promote the transformation from agriculture to industry by developing skills appopriate to work in more mechanised/automated production systems. Since 1965, the AMU system has also conducted training for skilled workers, thus promoting the mobility between sectors and enterprises.

B. Background and Goals

In the spring of 1987, DTI agreed with the Danish Plastics Industry's CVT committee that DTI would conduct a qualification analysis. The project was financed partly by the trade committee of the plastics industry and partly by the Technological Development Programme (TUP), which was an initiative taken by the Ministry of Industry in 1985-89. A steering group was created, consisting of CVT members and a representative from the Ministry of Labour's department for the AMU centres.

The analysis was called 'Towards Broader Jobs in the Plastics Industry'. Two main questions were addressed:

1. In which direction will the jobs develop?

Information technology was changing production technology, and the CVT committee wanted to know whether if there were qualification deficits or future demands as a result of this development.

2. What should be done to ensure that the education schemes produced the necessary qualifications?

This question related to educational structure, objectives and teaching methods. At that time, over 50 percent of the employees in the Danish plastics industry were unskilled women occupied in *narrow (operator) jobs* of item manipulation and simple machine operations. The normal way of recruitment at that time was to hire people 'from the street'. Training in these jobs was very limited and consisted of brief instructions from supervisors and colleagues.

The recruitment for installer jobs at these enterprises was different, as was recruitment at enterprises with broader jobs. In these cases, the enterprises had training strategies, using AMU courses or even hiring skilled plastics makers.

There was no doubt at all that the unskilled women in narrow operator jobs to a great extent were in danger - at least in the medium or long term - of losing their jobs, because these jobs were and still are subject to on-going automation, mainly at enterprises with larger production runs.

C. Methodology

The study comprised case studies at twelve enterprises. The selection criteria was technological sophistication in the production. This approach is called 'the spearhead' approach and is common in Danish qualification analysis. Advanced enterprises are chosen on the assumption that practices at these enterprises will spread to the rest of the industry in the near future. This has been the traditional DTI approach for investigating *future skill needs*.

The case studies consisted of both interviews and workplace observations. We first observed the *work functions* already existing and the qualifications which were used to perform the work tasks. Examples of work functions were 'planning', 'running-in' and 'item inspection'.

Our observations were then supplemented with interviews with employees and management representatives. The interviews had a broader aim and included topics such as 'learning strategies', 'problems in daily work (due to lack of qualifications)', 'use of tools' etc.

In this way, detailed descriptions of qualifications were given for each work function. The description of qualifications is thus to a certain extent the result of a 'translation' carried out by the consultant on the basis of observations and interviews.

We used a distinction between process-dependent process-independent qualifications. This terminology has been widely used in Danish projects but was originally developed at the Soziologisches Forschungsinstitut in Göttingen.

Process-independent qualifications was used as a term for attitudes and abilities in communicating and co-operating with fellow workers and superiors.

The following categories were used for process-dependent qualifications:

1) Sensory-motor regulation of work tasks
2) Perceptive-routinised regulation, i.e. ability to choose between and apply certain well-known rules to varying tasks
3) Regulation demanding 'technical intelligence', described as the ability to independent reasoning over unknown problems or tasks, making use of analytical thinking and inductive reasoning - in contrast to the usual academic-theoretical deductive reasoning.

Earlier investigations had shown that enterprises with the same technology and qualification structure had 'room' for different work organisations. In other words, there was some elasticity between technology, qualification structure and work organisation. This understanding was an integral part of the methodology.

One of the aspects subjected to intensive attention during the interviews at the enterprises as well as during the subsequent follow-up round was how many or how few functions the operators' jobs actually comprised, and how many or how few the consultants thought they ought to comprise. The analysis thus implicitly had a job-enrichment objective.

D. Results

The analysis should answer two main questions:

i) In what direction will jobs develop?

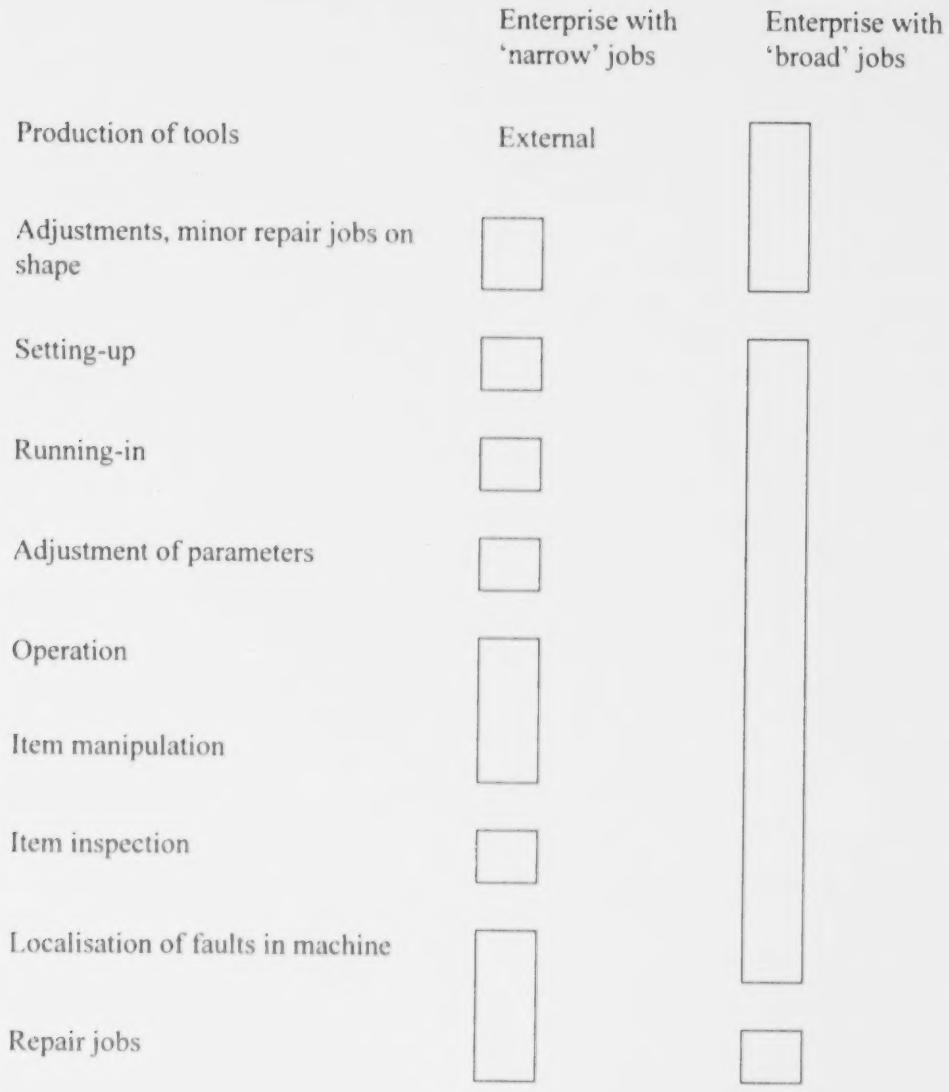
The qualification analysis concluded that as regards job content, the most decisive step would be a development of the job towards adjustments of parameters during production and towards actual setting-up functions such as running-in and setting-up. Most threatened by automation were the work functions of 'machine operation' and 'item inspection'.

Qualification needs were especially related to the frequency of switch-overs, the complexity of products and the materials used in the production, whereas new information technology was not of central importance.

It was also concluded that, to a very large extent, the enterprises were free to choose the form of work organisation. The analysis showed many different forms, among which were two extremes. See Figure 1 below which shows the two extremes of work organisation revealed by the analysis.

The main reasons for choice of a specific work organisation form was found to be either management philosophy, the wish to promote functional flexibility, existing qualification structure, resistance to change from the operators' colleagues and/or vocational demarcations.

Figure 1: Different types of work organisation

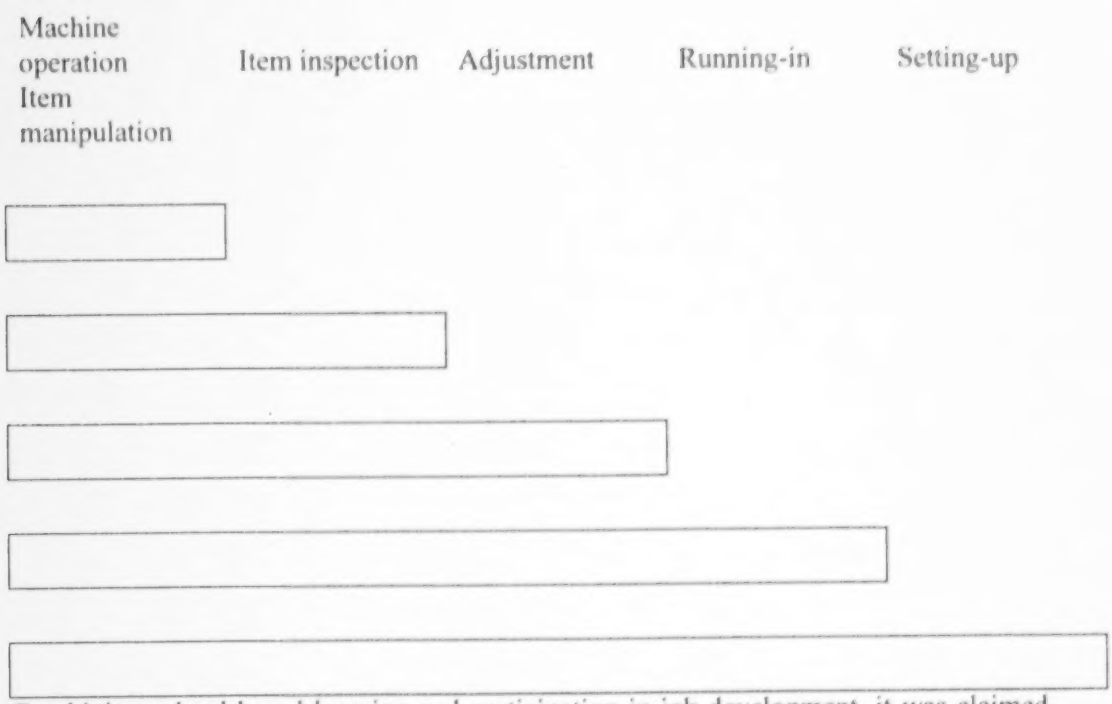


ii) How can the education schemes produce the necessary qualifications?

The report pointed to the need for developing training offers targeted at the possible *job developments* for the group of operators and, secondly, in the specific enterprise cases to create a connection between participation in training and job development.

It was recommended that teaching tools in *school-based learning should consider the operators' experiences with on-the-job training strategies*, that is, how the operators had originally acquired their qualifications.

It was recommended that courses should be developed which could support job development, and which would at the same time increase enterprise flexibility and develop new operator qualifications. An ideal model for job development was presented:
Figure 2: Step-by-step job development



Combining school-based learning and participation in job development, it was claimed, could result in broader jobs for the operators. The point was to make a step-by-step start of the job development, and it would probably be most appropriate for the first step to be inspection of the items handled by the operators. At first, it would be a visual inspection. The next step could be more thorough measurement according to the required quality standard.

E. Development of Courses

In the Danish Plastics Industry's CVT Committee, the qualification analysis was subject to in-depth discussions and was one of the Committee's inputs to the discussions on the establishment of a training programme within the AMU framework. This training programme was to be aimed at the operators who would otherwise not receive any training, unless they wanted to leave the operators' group by qualifying themselves through a longer plastics maker training scheme to enter the setting-up group.

A development process was initiated in which one of the consultants participated. The process resulted in the Basic Courses I and II. The aims of the courses were as follows:

* To give the participants a basic introduction to the plastics trade, plastics materials, production processes, etc.

* To teach them how to use relevant tools, how to read a workshop drawing and how to carry out test measurements
* To strengthen the participants' ability to collaborate, their flexibility, self-confidence and ability to solve problems
* To give the participants a certain knowledge of inspection technology in order to enable them to participate in the fault-tracing and adjustment of machines.

In addition, a course was later developed on quality management and quality control which in terms of content is a continuation of the qualification analysis.

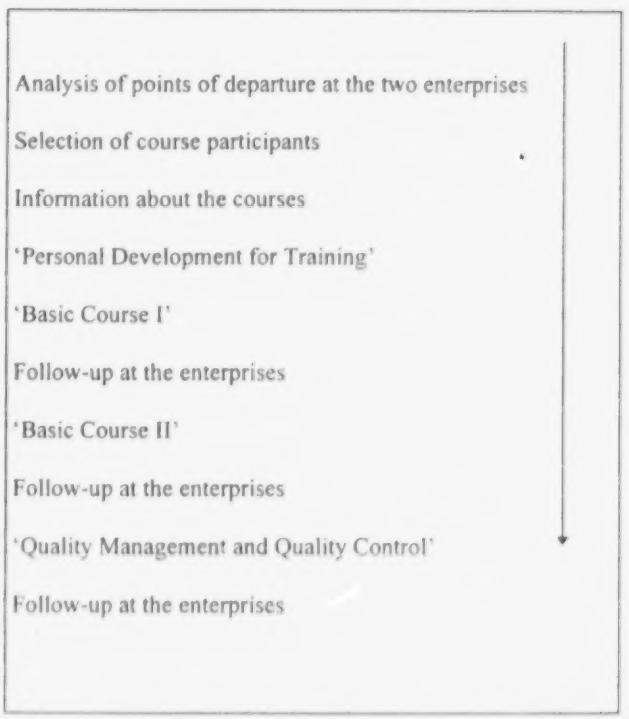
Together with a previously developed course 'Personal Development for Training', the above-mentioned courses formed the framework for training for the demonstration project and will be presented on the following pages.

F. Impact

The Job Development (Demonstration) Project 1991-92

In 1991, the CVT committee decided to demonstrate the ideas of the qualification analysis. After the recommended courses had been developed, it was now time to test the ideas of integrated school-based learning, work-based learning and job development.

The committee found two enterprises which wanted to take part in the demonstration project. A steering group consisting of the committee members and representatives from the two enterprises was then created. Both management and employees were represented on the steering group. The job for the consultants from the Danish Technological Institute was to analyse the points of departure of the two enterprises and to act as a contact for all persons involved in all parts of the course. 24 employees at two enterprises, A/S Nunc and Pharma-Plast, were to follow a course during which they would alternate between course participation and work. The project design can be illustrated as shown in the box.


Analysis of points of departure at the two enterprises
Selection of course participants
Information about the courses
'Personal Development for Training'
'Basic Course I'
Follow-up at the enterprises
'Basic Course II'
Follow-up at the enterprises
'Quality Management and Quality Control'
Follow-up at the enterprises

The courses were to be implemented within approx. one year, from Autumn 1991 to Autumn 1992. The four courses altogether lasted six weeks and took place during working hours.

In spite of several similarities, the backgrounds of the two enterprises, their points of departure and their production processes were so different that the project resulted in two different sets of outcome. The overall opportunities for job development for the operators as identified during the preliminary enterprise analyses were, however, very similar:

* The taking-over of single functions on/at the machines, typically single installers' or repairers' functions

* Increased participation in quality control and increased interaction with the quality department
* Participation in the daily planning of work

In this connection, it was emphasised that job development can assume various forms:

* Participation in several job functions, for instance simple fault-correction jobs and quality control jobs
* Improved interaction between different groups, for instance installers, repairers and quality controllers on the localisation of faults, quality evaluation and quality assurance, etc.

Barriers had to be overcome at both enterprises.

* The operators were not convinced that the installers and electricians would let them take over new functions and give them proper training
* Not all installers and electricians were keen on, or at ease with leaving certain functions to the operators
* The operators were not sure that they could cope with the changes

One enterprise succeeded in overcoming these barriers. This was partly because the production manager and the department managers offered very good support to the project and exerted pressure to put the training of the operators into strict frameworks, and partly because, at any time during the course, everybody involved was kept well-informed about aims, development results of the project, etc. An essential result was substantially improved collaboration between different vocational groups, increased respect for one another, more topics of conversation, and a more relaxed way of talking.

For the operators, however, the project also meant that they had to give up some benefits in order to obtain others. On the one hand, a result of the changes of work in connection with the project was more varied and satisfying jobs and, last but not least, a reduced risk of being laid off as a result of automation, but, on the other hand, the delays which previously occurred when waiting for an installer or electrician have now disappeared. It is no longer acceptable to remain passive when a fault occurs. The operators now have to try to correct it.

The project described here confirms that co-ordinated efforts with course participation and job development do pay off for the enterprises as well as for the individual employee.

The enterprise's time and money investments in systematic training planning, from the preparation stage to the follow-up after the courses, are rewarded in terms of:

- Less time wasted on machines
- Quicker reaction to faults in production
- Percentage of faults decreases
- Quicker running-in of new products

Through training the employees gain:

- Increased self-confidence
- Increased earnings
- Desire to learn more
- Improved collaboration
- The sense of being taken seriously

It was stressed in particular that older employees with little schooling, who were initially very worried about their ability to cope, in fact had a very positive experience from finding out that they could, of course, cope with both the courses and the development in their jobs. And in doing so, the risk of losing their jobs was reduced considerably. In addition, the project shows that course participation alone is not everything. The enterprises themselves play a very important role in ensuring the benefits of the investments in training.

Crucial elements are preparation, interaction with the AMU centre, and, not least, follow-up after the courses.

Another impact was the CVT committee's decision to communicate the results in 'a broad and intensive manner'. A report was prepared by the DTI which the social partners helped to spread in the Danish plastics industry. The report was designed for a broad public - not only for academic readers. It gave the background to and results of the project and described difficulties, experiences and gains at the two enterprises.

The CVT committee also took the initiative to arrange a one-day conference with about 120 participants - both managers and workers - from enterprises in the plastic industry. On the day of the conference, it was the employees and superiors themselves who told the participants about the project experiences and their thoughts on what would happen in the future.

The project has also had an impact on DTI's own methodological approach. In later qualification analysis projects, it has become more usual to attach reflections on how to develop qualifications within the framework of combined initial/continual vocational training and work-based training. This has been demonstrated in a later project (OVE[10],

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1991-93) where enterprises in a variety of industries used CVT courses and work-based learning initiatives to develop work organisations and autonomous groups.

5. Introduction to Case Studies 5 and 6

The Procedure for Producing Training Ordinances in Germany

In Germany, the whole process from commissioning a study to a new training ordinance is co-ordinated through the Federal Institute for Vocational Training (BIBB), the national research and development body for enterprise-based training. There are different people representing policy and practice of vocational training involved in different steps, but in its co-ordinating function the BIBB gives the process its continuity.

When the contents of a traineeship are in need of updating or a new traineeship is required for a new emerging occupation, the initiative for taking the corresponding action generally comes from the umbrella organisations of employers' associations, trade unions or the BIBB. Decision-making power rests with the competent Federal Minister (usually of Economics), who exercises that power after having heard the views of all parties concerned. The Institute usually submits an expert report on the matter or, particularly in the case of major reform plans, investigates these in a full-scale research project.

New traineeships are developed and existing ones are updated on the basis of a standard procedure adopted in 1978 which involves the two sides of industry and practitioners and researchers engaged in the field of vocational training.

The regulatory work has to give due consideration on the one hand to the binding nature of the future statutory instrument which lays down the goals and content of the training but on the other hand also take account of the pace of technological and social change. A training ordinance does not prescribe the application of any particular methodology or technical system. Instead it remains open to future developments by merely describing the skills to be developed during the traineeship.

Additionally, a number of important criteria - e.g. the macroeconomic significance of an occupation and adequate employment prospects - have to be met before the competent minister can give the go-ahead for reform.

The procedure adopted by the Board of BIBB (a four-party committee with the same number of representatives (16) from the Federal Government, the Federal States, the employers and the trade unions) for developing training ordinances involves four clearly-defined phases:

1. Research
2. Establishment of the 'key parameters' for the training ordinance
3. Development and co-ordination
4. Issuance of the ordinance

There are usually already talks with the social partners in advance of the start of this procedure. The Board of BIBB decides on research projects. The research phase might be skipped in case of less important changes or if there is sufficient evidence from other sources.

Phase 1

A position statement, usually drawn up on the basis of research findings, is required to shed light on the present situation. The process here also involves literature searches, hearing experts, surveys among employers and trade unions, and possibly large-scale empirical studies on the occupational field concerned (e.g. investigations into the state of the art, work organisation, the skill requirements of industry etc.). The resulting information is taken as the basis for drawing up hypotheses on which skills are needed to carry them out and therefore to be covered by the training. Constant contact with practitioners is assured throughout this process. All the work is ultimately synthesised to produce a draft decision document calling for the discontinuation, retention, updating or the creation of a new traineeship occupation. If an occupation is to be restructured, a draft for key parameters is developed, mostly by the social partners, and is presented to the competent ministry.

Phase 2

The parameters for the training ordinance are determined in what is known as an application consultation with the competent ministry (usually the Federal Ministry of Economics. The social partners, a representative from the Federal States and the BIBB take part in this consultation.

The parameters are:

1. Designation of occupation
2. Duration of training
3. Occupational field category
4. Structure (with or without specialisations)
5. Catalogue of skills
6. Structure of timetable

Phase 3

During the development and co-ordination phase, training specifications and skeleton curricula are developed and co-ordinated with each other to ensure consistency and finalised ready for adoption.

The BIBB requests the umbrella organisations of employers and employees to appoint experts who, as Federal Government consultants (representing the in-company training component), assist the Institute designing the occupation and training regime concerned.

The drawing up work is aiming at two parts of the ordinance, the so-called ordinance document (which lays down the designation, the occupational profile of the traineeship and the examination requirements) and the skeleton training plan (which lays down the structure of the material to be covered and the time to be allotted thereto.

Drawing on the work of the federal government consultants, state government consultants develop a skeleton curriculum for the school-based component of the traineeship. The two draft documents and the contents and the time concepts presented therein are then discussed and co-ordinated at joint meetings of the consultants.

The co-ordinated draft training ordinance is communicated to the Board of BIBB. The Board's approval of the working documents is a recommendation to the Federal Government to 'enact' the draft training ordinance.

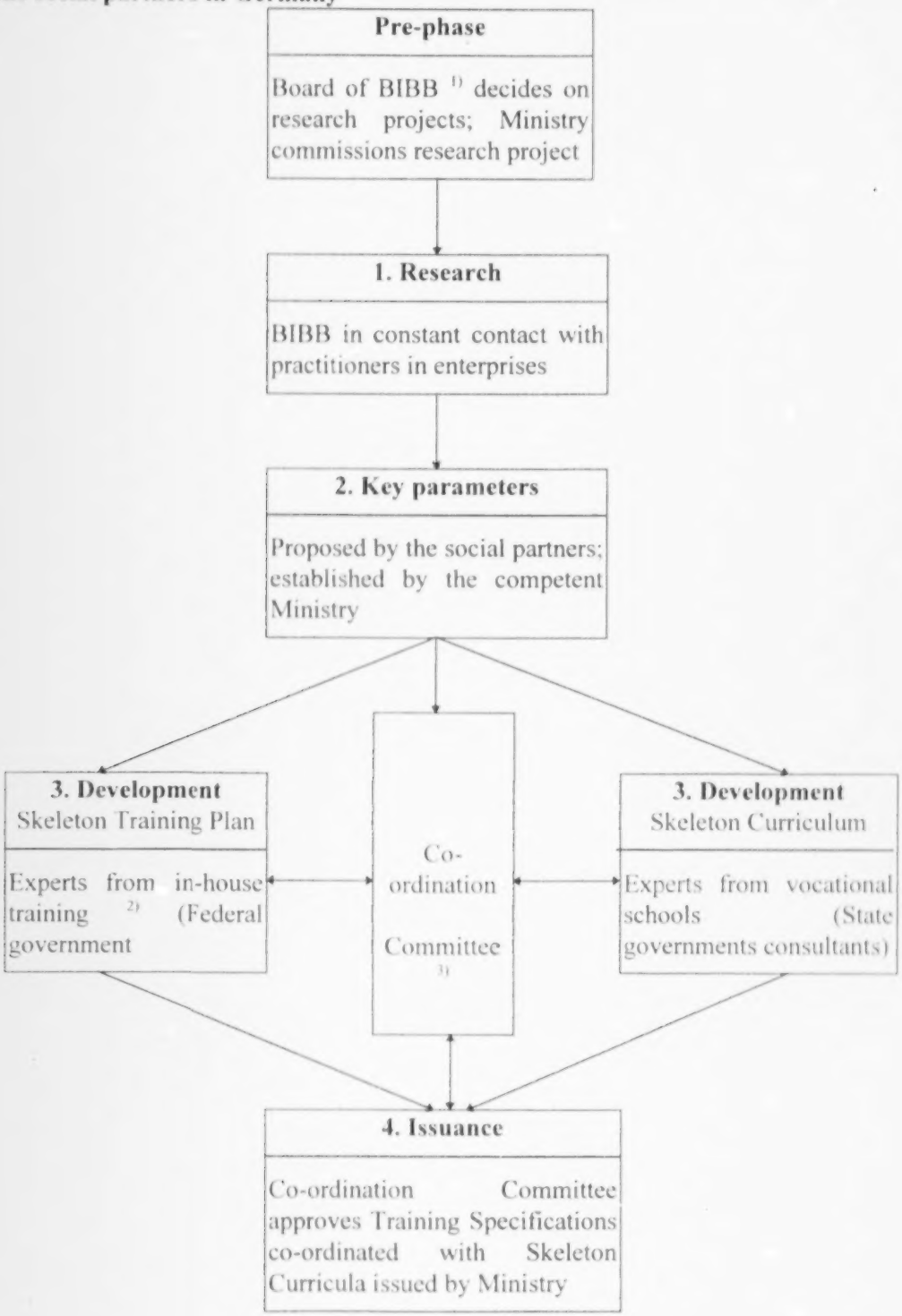
Phase 4

The Co-ordination Committee on Training Specifications and Skeleton Curricula approves the new training specification as co-ordinated with the skeleton curriculum. The competent Ministry subsequently issues the training ordinance.

Once the new ordinance is in force the Federal Institute for Vocational Training offers certain aids to cope with the practicalities of implementing it:

- Explanatory annotations to the ordinance;
- Teaching and learning media;
- Seminar concepts for training the training personnel;
- Pilot projects and dissemination of project findings.

Figure 1:The procedure for producing training ordinances and the involvement of the social partners in Germany


Pre-phase
Board of BIBB 1) decides on research projects; Ministry commissions research project
1. Research
BIBB in constant contact with practitioners in enterprises
2. Key parameters
Proposed by the social partners; established by the competent Ministry
3. Development
Skeleton Training Plan
Experts from in-house training 2) (Federal government
Co-ordination Committee 3)
3. Development
Skeleton Curriculum
Experts from vocational schools (State governments consultants)
4. Issuance
Co-ordination Committee approves Training Specifications co-ordinated with Skeleton Curricula issued by Ministry

1) The Board of BIBB is a four-party committee: Federal Government, States, Social Partners
2) Experts from in-house training are appinted equally by the Social Partners
3) Co-ordination committee: Competent decision-makers from the Federal and State Ministries

6. Case Study 5: 'Technological Development and Changing Demands on Qualification in the Construction Sector' and its Impact on the Revision of the Ordinance for 17 Construction Occupations

A. Preface

In 1993, the Federal Institute of Vocational Education (BIBB) commissioned a study on changing demands in the building and construction sector in order to support the discussion concerning a revision of vocational training regulations which date back to 1974. The study was carried out by a group of social scientists from the Hochschule Bremen in co-operation with groups from Hamburg, Dortmund and Jena. Section 1 relates to the goals, methodology and results of the study. Section 2 focuses on the question of the role and impact of the study.

Qualitative studies on trends in occupation and on qualification in the field of vocational education and training are a common approach in Germany in order to modernise and reshape ordinances and curricula for the various existing accredited and regulated occupations (at present totalling about 370) or to develop regulations for fairly new needs and new occupations. Details of the procedure are described in the introduction.

The inclusion of results of more general or of specially tailored research projects within the work of the expert committees is not prescribed but usually happens. BIBB itself carries out respective studies or functions as the commissioner of studies carried out by other private or public research institutes, mostly in the field of social and educational sciences. Different approaches in these studies can be observed, and the range of the case studies can cover one special occupation only, various occupation in a certain sector or the exploration of new demands with an effect on broad fields of vocational activities, such as the information and communication technologies.

The following case description is based upon an analysis of the study "Technological development and changing demands on qualification in the construction sector" itself, on questionnaires and source material for the study and on interviews with the researchers on one hand and the actors in BIBB and the expert committee on the other.

B. Goals and background

34 different state re-organised initial occupations (mostly level 3) currently exist in the German construction and civil-engineering sector. Some are regulated separately, but 17 of them, including occupations in strong demand such as that of bricklayer, are covered by a common ordinance for a staggered training and education scheme, starting from a common first year, followed by a second and third year of increasing

specialisation. After the second year and a possible specialisation in the 3 fields of structural engineering, civil engineering or interior construction a level 2 certificate can be awarded. But about 95 % of the trainees finish the third year with the option of one of 14 different occupations. The training regulations and school curricula were put into practice in 1974. Significant changes in the construction sector can be observed since that time, particularly regarding new materials and manufacturing technologies, new machinery, the reorganisation of work, new political and economic conditions and legislation. However, apart from minor adaptations, e.g. after the unification of Germany, the common ordinance from 1974 has fundamentally remained unrevised.

Discussions on the necessary revision of the training regulations and the curricula have recently been under way, and it is intended that final decisions will be reached in 1997. The process of negotiation and decision-making started in 1995 on various expert committees. The study reported here contributed mainly to the discussion of the preliminary phase where the "corner-stones" of the new regulations have to be decided upon. The study was commissioned by the BIBB and carried out by the research group "Employment, Work and Qualification" at the Hochschule Bremen under the chairmanship of Prof. Dr. Syben. The research group was selected on the basis of a call for bids in April 1993, when about 20 different institutes contributed with their proposed research designs and cost calculations. The study was produced from July to November 1993, delivered to BIBB in December 1993 and discussed on the expert committees in 1994.

The goals of the study were initially formulated in the call for bids mentioned and were defined in detail in co-operation between BIBB and the selected group of researchers on the basis of the proposed research design. The final goal was the identification of needs and demands for qualification in the various occupations of the building and construction sector with special reference to developments of technology and work organisation and to foreseeable future developments. Demands should be described at SEDOC levels 2 and 3 but not higher, both in the construction industry and in the crafts sector, including enterprises of different sizes and in different regions of Germany. The research should be based on but not strictly related to the 17 occupations in the existing ordinance and should take into account work planning as well as inspection activities. A strong emphasis on work site investigations was requested.

After negotiations it was finally agreed between BIBB and the group of researchers that qualification demands in the mentioned 17 vocations should not be investigated but all the activities in particular occupational fields. It should therefore not be asked which qualifications in terms of knowledge and skills a bricklayer, for example, must obtain but which work functions, which activities in a special enterprise and or at a special work site have to be fulfilled for instance in the occupational field of bricklaying. How and by which conditions are these activities influenced and will they possibly change in the future? In this approach the study should focus on activities which can be registered or observed, and not directly on qualification demands which must be deduced or decided within a range of options.

C. Methodology

The study was based on interviews with experts. To cover all kinds of activities and many types of enterprises 15 main occupational fields (Handlungsfelder) were defined and 4 different types of enterprises: small ones with less than 10 employees and medium-sized with less than 500, both in industry as well as in the crafts sector, big industrial enterprises and, fourth, specialised enterprises, working mostly only in one field. Additionally it has been assumed that these enterprises could be busy on construction sites in four main areas:

- Earthworks
- Structural engineering
- Civil engineering
- Interior construction

Multiplied by the 4 types of enterprises, a matrix of 16 fields resulted which should be represented in the study by an appropriate selection of firms. A total of 58 enterprises were included in the sample. As most of the 58 firms are busy in more than one of the mentioned 15 occupational fields of activity, a total of 114 interviews were undertaken. "Experts" in the meaning of the study were group leaders or site foremen, in small firms sometimes the owners, in larger ones the site engineers or other management staff, but not the workers themselves. An attempt was made to ascertain that the selected enterprises were typical and representative of the construction sector as a whole and of different regions of Germany including the new Federal States (Neue Bundesländer). However, the validity of the results was not found to be equally high because in some of the 15 fields such as well-digging, as only a few specialisd firms are represented in this field, not many interviews could be taken.

The interviews had to follow a certain structure and were based on a common questionnaire composed of closed and open questions in four different sections:

A. General information relating to type of enterprise, fields of activities, work organisation, structure and qualification of the working staff;

B. Planning, work site preparation and inspection of the different activities;

C. Specialised questions according to the different activities in the 15 fields and the respective use of machinery and tools;

D. Questions relatingd to deficits of qualification, trends of changes and new demands on qualification, as well as proposals of the experts or the firms regarding the initial or continuing training of their workers.

After a pre-test, the questionnaire was reformulated. 10 interviewers from 4 different research institutes or groups from Bremen, Hamburg, Dortmund and Jena were employed.

The analyses of the collected data and information comprised different steps:

- Survey concerning the extent to which workers of a special vocation are employed in other occupational fields;
- Producing detailed lists of activities in each of the various occupational fields;
- Conclusions on the demands on qualification, deficits and future trends.

D. Results

a) Work in different occupational fields

Most of the skilled workers or working groups of the different vocations are employed in more than one occupational field from at least one up to four additional ones. This means that vocational education and training should not be concentrated on one field only but include sufficient abilities to work in the most likely adjacent fields as well. In the following matrix the clusters which indicate the most closely linked occupational fields are obvious.

Occupational field transferring activities of skilled workers

skilled workers, mainly active in the field:	are also occupied in the field												
	3	4	9	10	5	7	2	8	6	12	13	11	1
3 well-digging	x	x	x										
4 earthworks		x	x	x									
9 road work		x	x	x		x	x						
10 civil eng.		x	x	x		x	x		x				
5 floor laying					x		x						
7 brick laying	x					x		x				x	
2 concrete work		x	x	x		x	x						
8 plastering						x		x			x	x	
6 tile laying						(x)			x			x	
12 carpenter									x	x	x	x	
13 dry building					x				x		x	x	
11 firming												x	
1 insulation									x			x	x

b) Quantitative results about activities per occupational field

As every expert interview was based on an identical list of activities which had to be marked according to the question as to which activities apply to a certain occupational field, it was possible to relate the activities to the fields and to calculate to what percentage the possible activities are represented in each field. It could be calculated by this calculation how broad a certain occupation was in the chosen sample and possibly should also be in the training profile. It also gives some information as to how far workers who are trained and experienced in a certain

occupational field can be successfully employed in others. Not surprisingly, it was found that most of the transfer activities appeared in nearly every occupational field. The differences in the special, occupation-related activities therefore proved to be more interesting. As demonstrated in the following overview the bricklayers showed a fairly broad range of tasks and activities with 28% of all investigated activities represented in their work. Surprisingly, the well-borer occupation included even more with 34%. In detail:

- Bricklayer	28%
- Concrete and reinforced concrete worker	28%
- Furnace and chimney construction	23%
- Carpenter	22%
- Plasterer	21%
- Tile and mosaic layer	15%
- Insulation fitter	13%
- Heat, cold and noise insulation fitter	18%
- Dry construction fitter	20%
- Road worker	30%
- Pipeline worker	30%
- Conduit worker	27%
- Well-borer	34%
- Track-layer	28%

c) List of tasks and activities in each occupational field

The central approach of the study was the identification of the various work functions, tasks and activities in each of the determined fields. Instead of defining abstract vocational qualification needs it was assumed that at least the knowledge and skills or, to put it more comprehensively, the competencies must be present successfully to fulfil the special tasks. As already mentioned, the interviewers used a common prepared list of tasks and activities, and it was primarily not a matter of open questions even if additional activities could be added.

Besides listing the special tasks and activities in each field, attention was also drawn to assignments which have to be fulfilled in nearly all fields requiring transfer knowledge and skills (Handlungsübergreifende Qualifikationen). The necessary qualifications were focused on 11 topics:

- Understanding of work assignments;
- Reporting and measuring;
- Work and process planning;
- Scaffolding;
- Maintaining of safety and health standards;
- Materials expertise;
- Machines and tools;
- Securing of the work site;
- Environmental and recycling aspects;
- Inspection, assessment and quality assurance;
- Installation and clearing of construction sites.

In general it turned out that competencies to handle these assignments and to know about these topics are of growing importance. It correlates with the observation that the trained worker increasingly should obtain abilities to plan and organise his workload independently after receiving a certain task or assignment. However, these abilities are required to a different extent, depending on the occupational field, the type of enterprise, the scheduling and organisation of work and, finally, also on the special group of workers collaborating in a certain environment and situation.

d) Deficits of qualifications and future needs

It proved to be very difficult to arrive at general conclusions about deficiencies . The answers given were often strictly related to the specific work situation and not the result of a systematic reflection based on extended and continuous experience. The most common feature described was the lack of qualification to deal with new materials, machinery and tools. In some special fields it was mentioned that many workers are not qualified for demanding tasks. But it did not become sufficiently clear how often such tasks had to be accomplished by the respective group of workers involved in the study, if at all.

Regarding transfer skills and knowledge it turned out that very basic skills such as reading, writing, measuring and arithmetic were very often missing so that, for instance the appropriate understanding of a certain assignment became difficult if not impossible. However, the results of the research do not allow these findings to be generalised because the background of the respective statements could not be investigated sufficiently.

With regard to future trends and needs, the answers given also proved to be more by chance than systematic. The interviewers themselves reported that - from a methodological point of view - a difficulty obviously arose in switching over from a more descriptive part of the interview with closed questions and "hard" facts to a more reflective one with open questions. However, the foreseeable trends and needs were mentioned, especially those related to new materials and machinery. The increasing importance of the restoration and refurbishing sector with its slightly different needs on qualification was also mentioned. To the surprise of the researchers, the dramatic changes in work organisation, project management, new industrialised manufacturing methods and in the changes of economic conditions were not stressed to the extent which might be expected. As well as a lack of reflective and prospective thinking, it was assumed that the type of interview itself was not appropriate enough to tackle this research interest sufficiently.

E. Impact of the Study

i) Impact on the Process of Ordinance and Curriculum Revision

As the study was commissioned by the BIBB, with the intention of revising training regulations and curricula for the existing ordinance from 1974, a direct and prior impact could be assumed on the perceptions and positions of the actors involved and on the decision-making process on the expert committees, and especially on the preparation of this process by BIBB in terms of information, data input, drafts and additional investigations.

Revision or drafting of regulations for training on the work-site in enterprises or in special off-the-job workplaces and, additionally, of the curricula for the related day or block release education in the vocational schools used to be quite a complex and time-consuming procedure in Germany. Since 1996 the intention has been to accelerate this procedure and to limit its duration to a maximum of two years, in the case of the revision of ordinances already existing to one year only. But hitherto the duration of these processes used to be much longer and consisted of the following three steps:

- Preliminary procedure, where the "Eckpunkte" (corner-stones) of an intended revision or a new design are decided upon;
- Drafting procedure, where mainly the BIBB, based on the 'corner stones', drafts a proposal for discussions and decision on the expert committee;
- Enactment procedure, where, after a consensus decision on the expert committee, the competent Federal Minister decrees the new ordinance and, accordingly, the KMK (Standing Conference of the Ministers of Education and Cultural Affairs of the 16 Federal States) decides on the recommendations for the related vocational school curricula.

In the described case of the construction occupations this process is still under way and now just approaching its second phase. The research study discussed here has therefore until now had its main impact supporting the preliminary phase.

Final decisions on the regulations and curricula are to a large extent determined by the diverse and often contradictory interests of the involved actors, such as the educational side, the social partners or even the various groups of enterprises such as industry and crafts. They are also influenced by political interests and conditions and by legislation and framework laws. Research studies can have a significant impact on these processes which usually will not be a direct adoption over or application of results into training regulations and curricula but at least stimulation or structuring of the decision-making process. There are often different research contributions and inputs.

In the investigated case of the construction occupations the results of the study were distributed to 48 experts and, in addition, presented by and discussed in common sessions with some of the researchers involved in the study. Apart from details, it was

agreed that the results of the study confirm the necessity for a revision of the common ordinance and the school curricula of the construction occupations.

The main impact of the study at this stage consisted in its contribution to a comprehensive survey of activities in 15 occupations of the construction sector which the skilled workers must be qualified for now and in future.

After discussion with the experts, this list of activities comprises 876 different activities. With regard to the results of the study 133 activities were identified which were more or less common for each of the 15 occupations. They constitute the basis for decisions on necessary transferable knowledge and skills which have to be taught, preferably in the first common year of the three-year apprenticeship. Out of the remaining 743 activities, the ones in most demand were attributed to the 15 occupations as far as they suited a particular field. In order not to overload the future qualification profiles and curricula, the attributed activities were also assessed by the experts following 3 criteria: A: very important, B: important, C: less important. The 15 occupational profiles thus comprise different numbers of activities. But the highest score does not necessarily indicate the broadest range of qualification because some of the grouped activities were very narrow by definition, while others were more comprehensively specified. The result was as follows:

1)	Earthworks	76 different activities
2)	Building with bricks	48
3)	Building with concrete	79
4)	Building with wood	50
5)	Insulation fitting	43
6)	Floor-laying	36
7)	Plastering	53
8)	Tiles and mosaic	26
9)	Dry construction	52
10)	Heat, cold and noise insulation	54
11)	Road works	54
12)	Conduit works	31
13)	Pipeline works	35
14)	Well-borer	69
15)	Track-laying	37

The amount of activities in each field in general corresponds to the reported results of the study.

In a third step the list of task and activities was compared with the goals and contents of the training regulations in existence. Deficits could be identified by this comparison. This was not only done for the special tasks and activities in each occupational field but also for the transfer knowledge and skills which form much of the content of the common basic year of training and vocational school education. Substantial deficits were found especially with regard to these transfer skills, taking the results of the research study into account. The following five fields of competence were mainly agreed as being of growing importance:

- Integrative, context and process knowledge
- Abilities to plan and decide
- Team and communication competencies
- Safety and health aspects on the work site
- Environmental protection and quality assurance.

Final decisions on the training regulations have not yet been taken. At this stage it is not intended that the 17 occupations involved will be fundamentally regrouped. The basic consecutive scheme with a common basic year and increasing specialisation in the second and third year is also to be kept. But it seems very likely that the common basic year will be changed with regard to the study in the direction that more occupation-related basic competencies will already be integrated in the first year. The goals and contents regarding transfer competencies will certainly be strengthened in accordance with the results of the research study.

ii) Additional Impacts

Possible but non-investigated impacts of the study can be assumed in the vocational school curricula and later on in the production of media and educational technology for training and teaching purposes.

It may also be a matter for further investigation whether the results of the study will in future have an influence on the reformulation of information and guidance material on construction occupations, which has not yet been the case but could be easily deduced from the results of the study.

As the study was carried out by researchers who at the same time work as teachers in the field of engineering, vocational school teacher training and continuing education, it already became obvious that results of the study were partly used for educational purposes, e.g. to provide more up-to-date information about work functions and future needs in the construction sector or to organise more comprehensive projects for training purposes.

The processes of design or revision of training regulations and curricula are far too complex to expect direct and comprehensive impacts of research or even one single study. Decisions taken usually cannot be linked to the results of one such study. Very often the case studies do not end up with final or applicable conclusions regarding training profiles and educational goals and contents as in the case described. However, the conclusion can be drawn that the results of this study significantly supported certain steps and decisions in the revision process and that they will have an additional impact for follow-up activities and the discussions on the expert committee.

7. Case Study 6: 'Foundations and Suggestions for a New Training Ordinance: Data Processing Clerk' and its Impact on Four New Ordinances in the Information Technology Sector

A. Preface

In 1969, shortly before the Vocational Training Act (the legal basis for in-company training in Germany) came into force, an ordinance for the traineeship occupation of 'Datenverarbeitungs-kaufmann' (Data Processing Clerk - DPC) was laid down and legally enacted; this ordinance remained unchanged until 1997. From 1992 to 1994 the Federal Institute for Vocational Training (BIBB) carried out a study to find the foundations for a new ordinance in this occupational field.

(For a better understanding of the following, the introductory chapter on the procedure for producing new training ordinances in Germany should be read first).

B. Background and Goals

Since the early sixties there has been steadily increasing demand for skilled workers/clerks in data processing. Emerging from the necessity to prepare business management data for processing, to guarantee the process itself and to provide the results in a suitable format for the different sub-departments, the profile of DPCs was created in 1969. They were supposed to work as an interface between the data processing department and the different sub-departments due to a combination of basic data processing knowledge and commercial contents. The number of traineeships in that occupation grew constantly over 25 years. In the whole computer business sector (300,000 employees in Germany today) the DPC is the only occupation regulated by a training ordinance covering just 3.5% of the workforce in this sector. The training ordinance remained unchanged, which might be surprising in view of the deep and rapid changes in the information technologies at the same time.

The speed of change in the economy and in technology might be the reason for conservatism in training: due to the rapid movement it cannot be clearly seen what should be fixed in a new national regulation. New economic/technological developments always tend to stay 'outside' the nationally regulated area, and the needs are covered by formal or mainly informal continuing training before they are incorporated into the national training system.

In the mid-eighties after the BIBB had already carried out a first study for a revision, the social partners could not agree on a new training or further training ordinance. Whereas the employers stressed the good employability of data processing clerks and the increasing demand, the trade unions considered DP to be a specialisation for office clerks and preferred a regulation in continuing training. To keep training up to date without a new ordinance the employers gave recommendations for the curriculum within the framework of the old ordinance in 1986 (and again in 1995). In

1992 the Board of BIBB commissioned the study 'Foundations and suggestions for a new training regulation Data Processing Clerk'.

The study was to analyse the following issues:

- The technical, organisational and personnel state of the art in the area in question
- Fields of activity of DPCs within the first few years after having completed training
- The present training situation
- The demarcation of initial and continuing training
- The connections with and the demarcation from other existing commercial training occupations

The findings were to be summarised and translated into a revised traineeship profile.

C. Methodology

An advisory committee for the project was established including the employers, the trade unions and a representative from the Standing Conference of the Ministries of Education (Kultusministerkonferenz der Länder). In collaboration with this committee 9 enterprises of different sectors and regions were selected for case studies, covering the main employment areas with the most typical working environments for DPCs. The DPCs working there were not statistically representative of all DPCs in Germany.

Members of the following groups were interviewed individually:

- Personnel managers (PM)
- Executive personnel in initial/continuing training (EIT/ECT)
- Trainers (TR)
- Apprentices (AP)
- DPCs in the first few years after training (DPCs)
- Workers committee/Youth and apprentices representatives (WCOM/YAR)

The sample

	Enterprises/Sample	PM	EIT	ECT	TR	AP	DPC	WCOM	YAR	Total
1	Trading enterprise	1	1	1	1	2	4	2	2	**14**
2	Software house	1	1	1	1	2	2	2	1	**11**
3	DP centre	1			1	2	2			**6**
4	Insurance enterprise	1	1	1		2	1	1		**7**
5	Chemical industry	1	1		1	5	2	1	1	**12**
6	Transport enterprise		1		1	2	1	1		**6**
7	DP service enterprise	1				1	2	1		**5**
8	Steel industry	1	1	1	2	2	2	1	2	**12**
9	DP industry (hardware)	1	1		2	2	2	1	1	**10**
		8	**7**	**4**	**9**	**20**	**18**	**10**	**7**	**83**

Apart from this enterprise sample, some experts from chambers and vocational schools were interviewed as well.

Questionnaires

There were two questionnaires: one to collect basic and structural data (on employees, trainees, trainers) from the companies, and one with open questions to guide individual interviews on the following items:

Personnel development

- Personnel needs
- Personnel recruitment
- Personnel development planning

Training

- Rank of DPCs training for the company
- Alternatives for DPCs training
- Criteria for the selection of applicants
- Training organisation
- Training programmes/material
- Training time
- Technical equipment
- Assignments/methods
- Rank of functional areas
- Division of work between company and school
- Out of date contents/learning objectives
- Necessary contents/learning objectives
- Strains/conflicts
- Key qualifications
- Duration of training
- Examination requirements
- Changes within the last 5-10 years
- Estimated demand
- Employment after training
- Interest in extra-company training

Occupational practice

- Functional areas/work places/activities
- Work tools, communication
- Strains/conflicts at work
- Self-assessment of status/qualification
- Aptitude of DPCs
- Requirements profile (lists with items)
- Career possibilities
- Estimated future developments

Continuing training

- Importance of CT for personnel management
- Internal/external CT
- DP courses/commercial courses
- Estimated needs
- General perspectives
- Relationship between initial and continuing training
- Forecasting of technological developments

The questions were not the same for the whole sample; they were clustered differently for the different groups depending on the different concerns.

In addition to the open questions lists were tabled with three sets of items concerning data processing and commercial skills/knowledge and personal (key) competencies to

be rated (1-4) by relevance to the occupation. The third column shows the overall average weight given by the interviewees.

Skills and knowledge in data processing (n=78)
0 = unimportant / 1 = less important / 2 = important / 3 = very important

1	Structured proceeding	2.6
2	Software engineering	2.6
3	Data media/data organisation	2.6
4	Imperative/problem oriented languages	2.5
5	Dat base systems	2.5
6	Commercial applications	2.4
7	Project management	2.3
8	PC architecture	2.2
9	Teleprocessing	2.2
10	Mainframe architecture	2.1
11	Standard applications	1.9
12	DP English	1.9
13	Object-riented languages	1.5
14	Machine-riented languages	0.9

Skills and knowledge in business/commerce (n=78)
0 = unimportant / 1 = less important / 2 = important / 3 = very important

1	Cost accounting and calculation	2.0
2	Bookkeeping	1.9
3	Company statistics	1.8
4	Procuring and production	1.7
5	Sales/marketing	1,7
6	Civil law and trade law	1.7
7	Labour law	1.6
8	Individual economic aspects	1.6
9	Environment protection	1.6
10	Safety at the workplace	1.6
11	Foreign languages	1.5
12	Financing, transfers	1,4
13	Personnel management	1.4
14	Wages and salaries	1.4
15	Introduction into economics	1.3
16	Investment	1.3
17	Taxes	1.3
18	National income and capital accounting	1.3
19	Economic situation, growth, employment	1.3
20	International trade relations	1.3

Personal features (n=78)
0 = unimportant / 1 = less important / 2 = important / 3 = very important

1	Motivation	2.8
2	Capability	2.8
3	Organising competence	2.8
4	Autonomy	2.6
5	Creativity	2.4
6	Improvising competence	2.1
7	Loyalty	2.1
	Work style	
1	Exactness	2.9
2	Endurance	2.7
3	Ability to take stress	2.7
4	Correctness	2.3
5	Punctuality	2.0
6	Speed	1.8
	Social competencies	
1	Ability to communicate	2.7
2	Team competence	2.7
3	Conflict competence	2.4
4	Negotiating competence	1.9
	Leadership qualifications	
1	Responsibility	2.8
2	Decision-making competence	2.5
3	Ability to motivate	2.3
4	Power to carry through	2.2
5	Delegating skill	2.1

D. Results

Most enterprises made a positive judgement on the *future demand for DPCs* and intend to continue to train DPCs in future. Depending on the sector they had different preferences concerning the breadth of employment.

The advantage of the DPC was seen in the *mixture of DP knowledge and business/commercial knowledge*. Importance should be given to a problem-oriented integration of both areas.

There should be a revision of the curriculum and the contents of the final examination with regard to recent developments in data processing. Quite a lot of the programming knowledge included in the final exams was considered to be out of date. *Programming* was considered important in future as well, but syntax-

independent logic and structured programming should be intensified; special programme languages are becoming less important. Training should give an overview on recent developments in DP systems to ease the change from one system to another.

The increasing work in planning, implementing, maintaining, user training of *standard software applications* requires practical operating instructions.

In future the handling of *database systems*, data security and data protection will be of great importance. The same applies to *networks*.

Due to the integration of application areas hitherto separate and the growing complexity of systems, the requirements in terms of *organisation and co-operation* are growing as well. Training should therefore should promote more key qualifications such as the ability to communicate and to work in teams.

In the 'commercial half' of the DPC, the basics of *business administration* and a solid knowledge of organisational structures and of project planning and management have to be trained.

New contents have to be integrated into the curriculum as regards *environment*, energy efficiency and recycling requirements.

E. Suggestions for Essential Changes in the Traineeship Profile

The findings were translated into traineeship profile positions. The figures in the rating lists were taken as indicators, not absolutely determining what has to be put into the profile. Even though skills and knowledge in business/commerce were rated as less important than DP skills they were given the same weight in the suggested profile. The high score of personal features/key competencies was mirrored in a range of action-oriented positions in the suggested profile.

Some of the former positions were skipped. The business/commerce-related positions were structured more fundamentally and systematically. The DP related positions were modernised as regards recent developments in that area. A group of new positions mixing DP and commercial skills was added concerning the application level. Here a paradigm change took place from mere special skills and knowledge towards action orientation: client/user counselling, project planning and management, service, communication.

The suggested profile gave a new shape to the DPC due to its interface function between system development independent of users and task-related use on the customer's side. The revised profile would provide the basis for further vocational prospects towards system development, network management, database development, DP co-ordination and more commercial profiles. The initial training for DPCs should form the basis for career prospects into leading functions (DP co-ordination). The rather technology centred approach was to be replaced by a more

process-oriented approach; the DPC should be able to work more as a counsellor and 'interpreter' for the customer.

F. Impact of the Study

The study was finished by the end of 1994. In May 1995 the report with recommendations concerning the main parameters for the new ordinance (designation of occupation, duration, occupational field category, structure of traineeship, catalogue of skills, structure of timetable) together with the traineeship profile were sent to the Ministry of Economics and to the social partners. During 1995 the former frame of reference for the study changed ,and this greatly affected its impact.

In August 1995 the German Employers' Council for Vocational Training (Kuratorium der Deutschen Wirtschaft für Berufsbildung) issued recommendations for the training curriculum in the framework of the 1969 DPC ordinance based on a survey including 1000 companies.

In late 1995 the association of the German Chambers of Industry and Commerce (DIHT) launched a campaign for 'New Occupations'. An initiative in response to this was the occupational profile for a 'Data Processing Systems Technology Clerk' published by a single chamber of industry and commerce comprising several important software houses. This profile was included in the DIHT list of New Occupations.

From the spring of 1995 on, IG Metall (the trade union for the metal sector) and the Deutsche Post Gewerkschaft (the trade union for postal services/telecoms) commenced investigating the wider IT occupational area. They designed an alternative concept for new IT qualifications on a more technical basis (one occupation with five specialisations, a revised DPC being one of them).

In January 1996 the BIBB in its function as a clearing house for VET in Germany organised a workshop bringing together the different proposals (including the revised DPC).

In May 1996 the experts from the employer and the trade union side agreed on the main parameters for four new training ordinances in information technology: (1) Information and Communication Systems Electronics, (2) Specialist in Informatics with the sub-profiles Application Development and Systems Integration, (3) Information and Communication Systems Clerk, (4) Informatics Clerk. The old training ordinance for the DPC should be split up and altered by the profiles (2), (3) and (4).

The main parameters were in principle confirmed together with the suggested profiles, i.e. a catalogue of skills, knowledge and key qualifications in the "application consultation". The Ministry of Economics, in agreement with the Ministry of Education and Research, requested the BIBB (mid-June) to start drawing up the new ordinances in line with the specifications previously agreed on; the work was supposed to be finished by the end of 1996. At the same time the curriculum

framework for the vocational schools had to be developed. Training according to the new ordinances should start in August 1997.

The BIBB requested the umbrella organisations of the employers and the employees to appoint experts to assist the Institute in designing the new training regimes. Each side appointed 15 experts, i.e. in-company practitioners, training executives and trainers representing the different occupational areas in question. Some of these experts had already been evolved as advisors in the study on the Data Processing Clerk.

In the rather rapid development procedure (9 months) the BIBB study on the Data Processing Clerk was an important source for the new ordinances. Nearly 90% of the revised DPC profile went into the four new profiles. The recommendations on new key qualifications (holistic process orientation, customer orientation, project management etc.) were taken into account in particular; they are essential for the identical core qualifications of the four new profiles, 50% of the training time across the full duration of the three-year courses are dedicated to them. Two-thirds of the suggested DPC profile positions form the major part of the core qualifications in the new profiles. The special skills and knowledge positions were split up into the different profiles, mostly into the Informatics Clerk and the Specialist in Application Development.

Profile for Data Processing Clerk

1. The training enterprise

- Tasks in training, position within the economy
- Legal form, organisation/decision making structures
- Vocational training and work law
- Safety, environment protection, energy efficiency

2. Functional areas of the enterprise and performance processes

- Materials management
- Production
- Marketing
- Accounting/Controlling
- Personnel
- Completion of orders

3. Information processing

- Basics of IP (hard and software)
- Data security, data protection
- Standard programmes and branch solutions
- Office automation
- Logic of programming, structured procedure
- Communication between information processing systems, networks and long distance transmission of data
- Planning, design, application and maintenance of db systems

4. Information processing and business administration application

- Needs and returns analysis
- Client/user counselling
- Project planning and management
- Application of software development tools
- Adjustment, optimisation and maintenance of information processing systems
- Testing and documentation
- Presentation of DP solutions and user training

Profile for InformaticsClerk

1. The training enterprise

- Position, legal form, structure
- Vocational training, work and pay law
- Health and safety
- Environment protection

2. Business and performance processes

- Attaining and utilising performance
- Business organisation
- Procuring
- Market and customer orientation
- Commercial steering and controlling

3. Work organisation and work techniques

- Informing and communicating
- Planning and organising
- Working in teams

4. ICT products and markets

- Application areas and tends
- System architecture, hardware and operating systems
- Application software
- Networking and information services

5. Producing and fostering of information solutions

- State analysis and conception
- Programming techniques
- Installation and configuration
- Data protection and authorship law
- Systems fostering

6. Branch-related performance

- Business processes
- Planning, steering, controlling

7. Framework for IT employment

- Enterprise organisation
- Work organisation
- Information organisation
- Personnel
- Accounting and controlling

8. Project management

- Needs analysis
- Conception
- Project preparation
- Carrying out the project

9. Procuring and providing of systems

- Buying
- Completion of orders
- Installation and optimisation
- Systems administration

10. User counselling and support

- Ergonomics
- Implementation problems
- Guidance and training

Apart from the DPC profile, other existing profiles went (partially) into the new profiles, as well as the contents of hiherto non-formal qualification. A wide range of other sources (studies, statistics from the federal employment agency and others) were brought together to accomplish the new profiles.

The work to draw up a training ordinance basically concerns the transformation of the occupational profile of the traineeship into the skeleton training plan, which means the breakdown of the profile positions into learning objectives, the time to be allotted thereto and the definition of examination requirements. In the case of the four new IT profiles, 10 profile positions for each of them with 33-41 profile sub-positions were broken down into 160-200 learning objectives. The main characteristics of the new training plans are: Common core/key qualifications, dynamic specialisations open to different rapidly changing employment areas, holistic qualification profiles covering the full process chain from problem analysis to implementation support with the customer.

Drawing on the work of the federal consultants, the State Government consultants (vocational school teachers) chaired by a representative of the Standing Conference of the State Ministries of Education developed a skeleton curriculum for the school-based component of the traineeship. Their work was based on the pilot scheme 'New Developments in Information Technology and the Traineeship Occupation Data Processing Clerk', run by the State Institute for Education and Tuition in Baden-Württemberg (responsible for curriculum development) on behalf of the Federal States Commission for Educational Planning and Research Promotion (1991-1995) involving four vocational schools.

The work was completed in March 1997.

G. Conclusions

In general: Due to the structural and even personal continuity of the whole process from preparatory research on trends in occupations and qualifications through the designing of occupational profiles of traineeships towards the skeleton training plan, studies on vocational training are in principle guaranteed to have a fairly large impact. This also applies to the special case described above. The methodology and the instruments used in the study in question have led to tangible results, i.e. a reshaped traineeship profile which was used for drawing up new skeleton training plans even though not within the suggested profile. An important impact was the discussion on and breaking-down of the limitations of the existing DPC profile.

After the results of the study and its suggestions had been published, the frame of reference changed substantially. New objectives were set up by the social partners and the Federal Government. The questionnaires used and the chosen sample were useful for the purpose of the revision of an existing profile according to the order given by the ministry but not for restructuring the occupational field.

Practical consequences drawn from the experience with the DPC and the new IT traineeship occupations are: new profiles responding to deep structural,

organisational challenges require permanent observation and early warning systems with a wider perspective including neighbour profiles and not yet formalised qualifications; case studies on 'typical' enterprises should follow truly representative surveys on trends covering the whole sector concerned. In future expert committees for the different sectors with delegates from social partners and research will be established to monitor changes in the various occupational fields.

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IV. CONCLUSIONS

1. Lessons Learned and Critical Remarks on the Case Studies

Because of a relatively small number of cases and a lack of time, this study could only be explorative. However, the following overall conclusions can be drawn.

Findings from occupational analysis are by no means copied for the sake of curriculum development, be it legislation in the form of training regulations or the development of educational plans. Curriculum development is a complex process which involves many actors and often has more than one objective.

It is very clear from the study that the social partners play a strong role which varies, however, from country to country, depending on the different national structures and procedures for revising or developing VET curricula.

In Denmark, joint committees which consist of members from the social partners are responsible for research processes and the content of curricula, and as such are free to choose methods of research. In the Netherlands, sectoral national bodies are responsible for the construction of occupational profiles and curricula, but the national bodies can appoint joint committees to be responsible for research processes and the establishment of occupational profiles (see case study 2). In this sense, the national systems and structures for the revision of occupational profiles and curricula in the Netherlands and in Denmark seem fairly decentralised. In Germany, research work is applied in a more centralised context, where the Federal Institute for Vocational Training (BIBB) decides the procedures for developing training ordinances.

The study showed that negotiation and bargaining processes take place at various levels. At macro level, both broader societal interests and interests related more to industrial relations are negotiated. At this level, the social partners and public authorities may agree on the overall objectives, for example overall objectives for training regulations, as is the case in Germany with the "Eckpunkte" (corner stones), which either already reflect research results or which define "the arena" for the negotiation of specific research findings. Another example is the balance between general subjects and special subjects in Danish vocational education schemes, where general subjects (e.g. foreign languages) are seldom altered by specific research results.

The social partners may be (partly) responsible for the content of vocational education, and therefore sometimes commission occupational research. The partners then negotiate results between themselves and decide which results should be used for curriculum development and which should not. At this level, the actors are often professionals.

When research results are transferred into curricula, it is often done by experienced practitioners from the enterprises, the public authorities, the employer organisations or the unions, who may be appointed by the social partners and/or the ministries and institutions responsible for vocational education. These actors mainly seem to use research results as inspiration for their formulation of educational objectives. The 'language' and methodology used by researchers may have crucial importance for the 'transfer' and 'translation' of research findings.

Research findings are discussed and mediated at all of these levels.

In addition to this rather general, but nevertheless important conclusion, many points of interest have been drawn to our attention:

- First, the impact is due to bargaining processes rather than being a smooth transfer of results

The revision and construction of curriculum is a process which involves the bargaining of interests rather than a smooth 'transfer' of research results. This bargaining process or power struggle may take place between the social partners or between the social partners and the public authorities responsible for training regulations.

This was perhaps most clearly shown in the Dutch study on inland navigation (case study 2), the German study on new training regulations for data-processing clerks (case study 6) and the Danish motor-vehicle mechanic study (case 3). These cases show the strong influence which the social partners have on the revision and creation of new training regulations in Denmark, Germany and the Netherlands.

The German study on new training regulations for data processing clerks showed how researchers' recommendations can be used in an unexpected way due to fundamental changes of vocational training policy. Initiated to revise an existing vocational profile, the results of the study were applied to create four new occupations and training plans according to their profiles.

- Second, it appears that specific research results are often an important but not the only information source for curriculum development.

Many supplementary sources of information play a role in decision-making, from official reports to locally expressed points of view and the actors' general impressions. This was the second main reason why there was no direct transfer of qualification descriptions to curriculum development.

Curriculum development work may be carried out by vocational experts with practical experience from industry. Perhaps because they have practical experience, they do not use the analysis results in a very direct and detailed manner. The experts instead seem to be seeking inspiration for their own formulations of educational objectives.

There may be a dilemma between the advantages of 'practical experience' and the 'narrow' focus which practitioners may have. At least these people should be chosen, so that they represent broader views.

- Third, the researcher should perhaps be more concerned with the stimulation of curriculum development rather than focus only on the research itself.

The various methods and the terminology in qualification analyses have their origin in industrial sociology, whereas curriculum development/educational practice is (partly) a matter of vocational pedagogics. It may facilitate the impact of the research if this is acknowledged by researchers, both with regard to methodology and if the study includes reflections on educational practice.

In Denmark, for example, the methods applied by DTI were derived from industrial sociology. A question was whether it can be used for other sectors and occupations. The original categories used by Mickler et. al. seem closely related to work in manufacturing industries. This does not mean, however, that the basic methodology cannot be used in other sectors. A little pluralism may be useful. As shown in the Danish motor-vehicle mechanic study (case study 3), it may make sense to use categories in the analysis which are familiar to vocational educationalists. This may be rewarded by easier transfer of results to curriculum development. But it also makes sense to describe work functions in a comprehensive way in connection with the assumption that skilled workers should be able to/have the competencies to perform these work functions. An example of this was shown in the German case study 5, where about 800 work functions were described for 17 occupations in the field of construction.

Researchers may also structure their results in a way which makes it easy to use them in curriculum development.

- Fourth, a distinction should be made between need-oriented and demand-oriented approaches.

All the methods described in this report include investigations of work functions, not just opinions from various actors. There is an essential distinction between qualification needs as can be derived or deduced from technological or work organisation structures or observed or deduced from policy-oriented overall objectives in the economy, and qualification demands as expressed by managers, workers or other actors. Need-oriented research appears to facilitate the use of research findings for curriculum development. 'Needs' somehow have to eventually become 'demands', in other words, they must be taken over by actors in order to become part of the negotiations or the solutions to be found. In this sense, it seems to be more useful to start from more analytically-based and 'objective' 'needs' rather than more subjective, interest-related and heterogeneous 'demands'.

- Fifth, how can research describe 'the future'?

There are no easy answers as to how research can describe what vocational education should look like in the future. Two attempts can be mentioned here:

The 'market scanner' method, which can be examined in case study 1, is suitable for example for giving a representative picture of the trends which enterprises in a particular industry at present consider important for the future development of qualification needs. The method can be described as an early-warning instrument.

The qualification analysis method described in case study 4 aims to give a picture of future qualification needs in an industry, assuming that technologically sophisticated enterprises represent the future. It still seems to be proven, however, that the methodology's assumption that 'technology will spread from the advanced to the less advanced enterprises' is also valid for sectors and industries other than manufacturing industries.

- Sixth, there may be a difference between research which aims at the revision of existing forms of education, and research aimed at the development of new forms of education or educational practices.

Setting out to revise something that already exists may imply a narrower focus than creating the guidelines for something new. Case study 4 shows how action research can demonstrate the full potential of new CVT courses on job improvement. Such an objective obviously implies the choice of different methods and researcher roles than more 'traditional' research does.

- Seventh, can the results of action research be generalised?

Case study 4 shows how action research may promote the development of more enriching jobs, but it also describes the many practical obstacles to this process at various levels. One crucial point is to involve the actors by 'bottom-up' approaches. But even then, a central question seems to be how to facilitate and embed self-governed, continuous learning processes in work organisations.

It seems an open question whether and how action research methods could be applied in the development of initial vocational education and training.

2. Suggestions for Further Studies

Some main questions arise from the results of this explorative study:

- How can the dialogue between the researcher and the actors in curriculum development be increased/developed?

The researcher may be able to increase the impact, both by extending his or her 'traditional researcher roles' and by changing the way research findings are structured and presented to other actors. How can researchers maintain their integrity and at the same time focus more on 'delivering results'?

- How are research results 'translated' into educational objectives in curriculum in practice?

This question proved to be a crucial, but also a very difficult question, which is only vaguely covered in this study. A better understanding of this question may prove useful knowledge to researchers in the future.

- How can the impact of research findings be extended for example to educational practices and teacher training?

It appears that due to the existence of different (sub)systems and actors, research findings are sometimes only used to develop or revise curricula, whereas they could also be useful in other fields, for instance for educational practices. Maybe a better dissemination of information could help release this unused potential?

- How to bring the different levels of decision-making and various actors together?

Research findings are mediated at various levels and by different actors, and the impact might improve if these levels could be brought closer together. The case studies point to methods such as seminars, information campaigns and changed research roles, but further research may examine this question in depth.

Deciding on further studies, one way to go would be to investigate what the picture looks like within other institutional frameworks, for instance how modular educational systems like the British NVQ system are revised. Another might be to investigate studies which have used different methods than the ones described in this report. This would give a broader knowledge of the topics.

Another direction would be to investigate in greater depth some of the questions we have raised above. This may be done by looking into more cases using the same method, or cases within the same institutional network, thus keeping some factors 'constant'. This could increase the understanding of the complex processes in curriculum development.

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An explorative study

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